

# POPULAR **Computing** WEEKLY

24 June 1982 Vol 1 No 10

**30p**

**Shark attack  
on ZX81**

**Reviews:  
ZX81 assembler**

**ICL education  
tapes**

**Vic A-maz-ing**

**Telesound 82**

**Spectrum graphics**





## KAYDE Electronic Systems ZX80/1 ZX KEYBOARD WITH REPEAT KEY

**£37.95**  
inc VAT

Fully cased keyboard ..... £37.95  
Uncased keyboard..... £27.95  
Keyboard Case..... £10.95

This is a highly professional keyboard using executive buttons as found on top quality computers. It has a repeat key and comes complete in its own luxury case. This is a genuine professional keyboard and should not be confused with toy keyboards currently available on the market.

## KAYDE 16K RAM PACKS

The 16K RAMPACK simply plugs straight into the user port at the rear of your computer. It is fully compatible with all accessories and needs no extra power and therefore it will run quite happily on your Sinclair power supply. It does not over-heat and will not lose memory at all. As you may know, some makes go down to 11K after being on for a while.

This 16K RAMPACK is very stable and will not wobble or cause you to lose your programme. It comes fully built and tested with a complete money-back guarantee.

**£29.95**  
inc VAT

## KAYDE FLEXIBLE RIBBON CONNECTOR

*Stops movement of RAM PACK and other accessories  
(Not needed with a KAYDE RAMPACK)*

**£12.95**  
inc VAT

## KAYDE 4K GRAPHICS BOARD

The KAYDE Graphics Board is probably our best accessory yet. It fits neatly inside your ZX81. It comes complete with a pre-programmed 2K Graphics ROM. This will give nearly 450 extra graphics and with the inverse makes a total of over nine hundred.

The KAYDE Graphics Board has facilities for either 2K of RAM (for user definable graphics), 4K of ROM or our 4K Tool Kit Chips that will be available shortly. All the graphics are completely software controlled, therefore they can be written into your programmes. Here are a few examples: **A full set of space invaders — Puckman — Bullets, Bombs — Tanks — Laser Bases and Alien Ships.**

**NO EXTRA POWER NEEDED**

**£29.95**  
inc VAT

## KAYDE 16K GRAPHICS BOARD SOFTWARE

**PEGMAN:** The only true ZX version of the popular arcade game.  
Centipede: "In all I think this is the best presented moving graphics program I've yet seen." Phil Garrett, Interface.

**SPACE INVADERS:** The best version available anywhere. Graphics software can only be used with a graphics board.

## KAYDE 16K 81 SOFTWARE

Centipede: "In all I think this is the best presented moving graphics program I've yet seen." Phil Garrett, Interface.

**3D/3D Labyrinth:** A Cubit Maze that has corridors which may go left, right, up, down. Pledman (the latest addition in 81 games).

**WHY WAIT TO PAY MORE —  
FAST, IMMEDIATE DELIVERY**

Post to: Dept PW2  
Kayde Electronic Systems Ltd  
The Conge  
Great Yarmouth  
Norfolk NR30 1PJ  
Tel: 0493 57867 (Dept. PW1)

*Don't forget you can always order on  
the telephone with your credit card*

All products include VAT are fully  
built and tested and come with a  
**COMPLETE MONEY BACK GUARANTEE**



|                     |                              |             |
|---------------------|------------------------------|-------------|
| Please send me..... | ZX Keyboards with repeat key | £37.95 each |
| Please send me..... | 16K RAMPACKS                 | £29.95 each |
| Please send me..... | Flexible ribbon connectors   | £12.95 each |
| Please send me..... | 4K graphics boards           | £29.95 each |
| Please send me..... | 16K graphics board software  | £5.95 each  |
| Please send me..... | 16K 81 software              | £5.95 each  |

I enclose.....

Name.....

Address.....

.....

.....

Please add £1.50 p.p.s for all hardware and 50p for all software. Please make  
cheques payable to Kayde Electronic Systems Ltd.

# POPULAR Computing WEEKLY

## The Team

### Editor

Brendon Gore

### Reporter

David Kelly [01-930 3271]

### Sub-editor

Peter Harvey

### Editorial Secretary

Fiona McCormick

### Advertisement Manager

David Lake [01-839 2848]

### Advertisement Executive

Alastair Macintosh [01-930 3840]

### Managing Editor

Duncan Scott

### Publishing Director

Nick Hampshire

Popular Computing Weekly,  
Hobhouse Court, 10 Whitcomb Street,  
London WC2  
Telephone: 01-839 6635

Published by Sunshine Publications Ltd.

Typesetting, origination and printing by  
Chesham Press, Chesham, Bucks

Distributed by S M Distribution  
London SW9, 01-274 8611. Telex: 261643

© Sunshine Publications Ltd 1982

### Subscriptions

You can have Popular Computing Weekly sent  
to your home: the subscription rate is £19.95 per  
year, for addresses in the UK.

### How to submit articles

Articles which are submitted for publication  
should not be more than 1000 words long.

All submissions should be typed and a double  
space should be left between each line.

Programs should, whenever possible, be  
computer printed.

At present we cannot guarantee to return  
every submitted article, so please keep a copy.

### Accuracy

Popular Computing Weekly cannot accept any  
responsibility for any errors in programs we  
publish, although we will always try our best to  
make sure programs work.

## This Week



Cover: Submission by Ben Craig

### News 5

Assurance on BBC delivery.

### Club Reports 7

Lessons learnt at Manchester.

### Shark Attack 8

Dave McGuire explains how to kill  
marauding sharks.

### Reviews 10

Telesound 62, A-maz-ing Vic-pack  
and ICL's "Fun to Learn" series  
for the ZX81.

### Open Forum 12

Seven pages of programs for the  
Vic-20, BBC Micro and ZX81.

### Programming 21

Memory saving techniques by  
Stephen Devine.

### Spectrum 22

Nick Hampshire examines more of  
the Spectrum's graphics facilities.

### Hand & mouth 23

Macro Assemblers and Reverse  
Polish Notation.

### Sound & vision 24

Three graphics tricks for the ZX81  
by Nick Godwin.

### Peek & poke 25

Your questions answered.

### Competitions 26

Puzzle, crossword.

## Editorial

With the advent of the Sinclair ZX  
Spectrum and the new range of Com-  
modore Vics, there is a growing mar-  
ket for second-hand microcomputers.

Budding programmers, who learn  
their skills on the ZX80/81, are now  
looking for more advanced machines.  
Consequently, they are also looking to  
trade-in their old machines.

The era of the used micro is now  
upon us.

No one is quite sure, yet, what  
effects the second-hand market will  
have on microcomputer users and  
manufacturers. But some trends are  
already becoming apparent.

It is now possible for a first-time  
user to buy a second-hand 1K Sinclair  
ZX81 for around £50. This puts micro-  
computers within range of more peo-  
ple than ever before.

Present ZX81 owners will also find it  
easier to buy more expensive  
machines, using the money gained  
from selling their existing ZX81s.

There are pitfalls in buying second-  
hand micros, just as there are in  
buying second-hand cars. But, if you  
take reasonable care to ensure that  
the micro is in good working order, you  
could get yourself a bargain.

## Next Week



It's an android  
world and you must master the art  
of robot control — another  
game to test your wits

# Classified

"ASTEROIDS" for unexpended VIC-20. Arcade type game on cassette, £3. Tel: 0170 470362.

**SELLING ZX81 SOFTWARE.** Quality famous material. (Rating Spectrum.) Knockdown prices. Tel: 01-455 2992. 6-10 pm first Saturdays.

**ZX81 18K.** Large keyboard, cassettes and books. Make me an offer. T. McGuire, 25 Stanham Gardens, Strim Hill, London SW2.

**ZX81 18K.** £30-worth software on 12 tapes including Galaxians, £100. Tel: Swindon 770401.

**ZX81. NEW 18K RAM.** Fourteen games programs, including 3D Defender, 3D Munster, Maze and Invaders, £100. Tel: Watford 37918.

**ZX81** plus separate keyboard/computer keyboards type plus manual and three books, £80. Tel: 041-942 4470, 6 pm.

**ZX81 18K,** one month old plus two tapes, £30. Tel: Cardiff 735787.

**ZX81 18K,** under guarantee. Six program cassettes (Invaders and Marzipan), £90. Tel: Totton 581183.

**ZX81,** perfect, with manual and games, £45. Tel: 054 8846.

**3.5K VIC SOFTWARE.** 34-run, 50-fps, action, optional joystick control.

**£5.95 T. Haywood.** See Gimpex, Colley, Brixport, Dorset.

**VIC-20 COMPUTER CASSETTE.** aims RM20 intro, best books, covers, software, as new, £170. Tel: 01-603 0302.

**ZX81 with 18K RAM,** plus many books and tapes, good condition, £30. Tel: Woking 71751 day; Canterbury 22688 evenings.

**FILER FOR BBC MICRO.** Create your own data-files. Define the record format and FILER becomes a complete editor. Options include: Insert, Delete, Find/Load, Save, Sort and Jump. For Model A or B. FILER cassette has over programs, nine data-files. Send £12.50 for cassette, documentation and fully card to: ADP, 23 Walsby Manor, Stansbury, Milton Keynes, Bucks.

**BBC SOFTWARE CASSETTE No. 1.** Lunar Lander and Attack. £5. Cassette No. 2: Adventure, £5. 6th St. P. Hammonds, 5 Redborough Road, Dorridge, Solihull, W. Midlands.

**CONVERT YOUR ORDINARY CASSETTE** to run on VIC-20. Complete instructions, £2 + 54C. RMPL, 3 Canberrae Road, Sharnbrook, Bedfordshire.

**WOMEN, AMOK,** both 3.5K (one set only), £10. Ring now: 01-665 6374.

**ZX81 18K,** crane keyboard and (88k, books, manual, various games, tapes, £35. Tel: Brown, 051-623 1186, day-time.

**ACORWATON 12K + 12K.** Nearly new with improved keyboard - PSU - Games, £190. Tel: 01-668 5684.

**ZX81 KITS.** Inverse Video £2.95, built £3.55, repeat key £3.75, built £4.85. Memory crashes and top line start cured, £2.95 plus 40p post and packing. B. A. Reader, 45 Ashed Street, Kings Heath, Birmingham B14 7HD.

**ZX81 18K** plus over £30 of tapes and books, including ICL programme course, £100 plus J. Hall, Tel: (0633) 55451.

**VIC-20** with Acton expansion unit, 20K RAM cassette and software, £450. Tel: Ngaz, 0203 442979.

**ZX81 18K,** excellent condition, two books plus many tapes, £75. Tel: 01-471 3364.

**ZX81 18K RAM, DK.** Thomas Graphic ROM, 2K UCG available, PSU, leads, etc., books, software, 3 months old, real bargain, £30. Tel: Heston 57117.

**ZX81 18K RAM** (sold in package) with joystick, 10K tapes, and books, only two months ago, vgr, £100. Tel: Inglebourne 42801.

**VIC-20** and VIC cassette plus program book. Cost £35, will deliver anywhere in London. £200 wanted. Tel: Doug - 01-789 8100.

**ZX81 BLEEP.** Provides audible feedback. Improves your keyboard cheaply. Its inside Simple plug-in, no soldering connections. Aids faster more accurate programming. £8.95 includes instructions. PMP+VAT. Futuron Products, Dept. W, Hildale, Steep Lane, Finton, W. Sussex.

**TR0-80 18K U8.** Includes keyboard, numeric keypad, leads, box, modulator, amplifier and £500 worth of software (games, utilities, only 12 months old. Tel: (Dares) 01-349 9051 evenings.

**PACMAN** on BBC Micro A and B. Addictive arcade game on cassette. Send £4.95 to J. Fryce, 59 Nether Cume Road, Cume, Edinburgh EH14 5HX.

**18K ZX81** plus many program 34999-ties, chess, friends, adventures, courses, £130. Tel: 021-563 8734.

**VIC-20 (UNEXPANDED); PROGRAMS:** Soccer, Collision, Infection, Car race, A-mazing, Insect, all six for £2.95. A. Spencer, 230 Low Grange Avenue, Bellingham, Cleveland.

## CLASSIFIED ADVERTISING RATES:

Line by line: For private individuals, 20p per word, minimum 10 words.

For companies, traders, and all commercial bodies, 40p per word, minimum 20 words.

Semi-display: £10 per single column centimetre, minimum length 3 cm. (Please supply A/W as PMT. Or supply rough setting instructions.)

Popular Computing Weekly will give you one free classified or semi-display advertisement for every two booked.

Conditions: All copy for Classified section must be pre-paid. Cheques and postal orders should arrive at least two weeks before the publication date. If you wish to discuss your ad, please ring Aislinn Macintosh 01-690 3640.

## Here's my classified ad.

(Please write your copy in capital letters on the lines below.)

|  |  |  |  |
|--|--|--|--|
|  |  |  |  |
|  |  |  |  |
|  |  |  |  |
|  |  |  |  |
|  |  |  |  |
|  |  |  |  |
|  |  |  |  |
|  |  |  |  |

Please continue on a separate sheet of paper.

I make this ..... words, at ..... per word so I owe you £ .....

Name .....

Address .....

.....

.....

Telephone .....

Please cut out and send this form to: Classified Department, Popular Computing Weekly,  
Hortons Court, 19 Whitcomb Street, London WC2

## Acorn quells fears over BBC delivery

ACORN have confirmed their commitment to fulfil orders for the BBC Model B by mid-August.

However, orders from as long ago as November 1981 still remain unfilled.

An Acorn spokesman explained that a "very large number" of the B models were shortly to be produced.

He said that the delivery dates being given to would-be owners by BBC Marketing were

unduly pessimistic, being based on "current production figures".

To ease the difficulties, some Model As are being converted to Model Bs.

However, the main Model A manufacturers, Clearstone Electronics, has now been sold to the AB Electronic Products Group.

The purchase, for an estimated £250,000, ends a period of uncertainty for Clearstone, formerly in receivership.



The BBC's much-awaited micro.

Henry Kroch, AB's chairman, said: "Production of the machine will continue and benefit from the takeover."

AB Products Group, founded in 1935, had a turnover of over £2m in 1981.

John Radcliffe, of BBC Continuing Education, said the Corporation was "delighted that a firm financial base had been found for the Clearstone operation".

## Sinclair aims for the main stream

Sinclair Research is to produce a new up-market machine.

The micro, as yet unnamed, is to be aimed in the mainstream business user.

It will incorporate the new ICL Bit-screen terminal, full colour and extra memory. The machine uses Sinclair Basic and single-key word entry.

Development of the machine is well advanced and pre-production machines are on trial with certain business users for evaluation.

The new micro will sell for less than £350.

## Fewer make a show of it

Despite being more than twice the size of last year's show, only 8,000 visitors attended the 3rd International Commodore Computer Show (June 3-5).

Those who came, 3,500 less than in 1981, saw the largest single-manufacturer show yet staged in the UK.

A Commodore spokesman said: "Despite the marketing lull, in commercial terms, the show was a resounding success."

The outstanding feature — apart from the first UK appearance of the Vic-20 — was the large number of exhibitors displaying Vic-20 software.

Jack Trumick, Commodore's Chief Executive, praised British companies. He said: "The show reaffirms my belief that the UK leads the world in micro software expertise."

## ZX82 back in full production

Manufacture of the Spectrum has now been restarted, following the production set-back reported in last week's issue.

The first production batch, which was returned to Timex, has been modified and was dispatched from Dundee on June 5.

The exact size of the delivery is not clear, but estimates suggest "several thousand" units are now on their way to buyers.



Vic-20 software proved to be the big hit of the show.

## Commodore hijacks Spectrum to America

Robin Bradbeer, co-editor of the Sinclair Spectrum manual and one-time education consultant to Commodore, has lost his Spectrum in America without his permission.

The theft happened at the Commodore Show, Bradbeer said: "People were interested in seeing the Spectrum so I took mine to show them."

"I took it in on Friday and Kit Spencer (Vice-President, Commodore Marketing) asked if he could borrow it overnight. I reluctantly said

OK and arranged to get it back from him at the show at 11.30 on Saturday."

"I walked around but he never turned up. At 4 o'clock they told me that Kit had got the 11 o'clock flight back to the States."

Bradbeer is considerably embarrassed by the proceedings and is "very, very angry".

He said: "I just walked out with a Vic and a Spectrum IV from the exhibition and I said 'I'm taking these off you give me my Spectrum back'."

## Ad leaflet ejected

Leaflets advertising the Sinclair Spectrum were unceremoniously ordered out of the Commodore show in London on June 3.

The leaflets were an insert into Micro Forecast, the free

fortnightly computer newspaper.

An organiser told the company that if they didn't take the leaflets out of the newspaper he would shut the stand down in 15 minutes.

## A machine that speaks

Wideband Products has just launched a new speech synthesizer.

The unit connects in the micro through an 8-bit parallel port and can be used with most machines including the BBC and PET.

Unlike some types of synthesizers, the Wideband model does not have a particular dictionary of words that it can generate but, instead is capable of being instructed to say anything. This is because the machine is programmed to recognise phonetic groups rather than whole words.

Each word is laid in as a series of sound groups. In the basic model it is necessary to key in code numbers associated with the various sounds, and a dictionary is supplied listing the phonetic groups and their codes.

A software package is also available which enables the synthesizer to recognise the phonetic letter-groups directly.

Wideband is currently working on an advanced application for the Anglia Water Authority. The speech synthesizer is incorporated in a unit which will be placed on a river bank. Sensors in the water monitor conditions, such as pollution level or water height.

The basic model is £89 and the additional software pack is £10 (both exclusive of VAT).

# Chrisalid -

BERKHAMSTED'S  
COMPUTER  
STORE

Watch this space for the real  
computer BARGAINS every week!  
EPSON MX801H £355+VAT — EPSON



MX80 tractor only  
£315+VAT  
VIC20 at  
£173+VAT  
VIC case



unit £39+VAT — range  
all VIC software.

CALL  
US FOR  
A QUOTE

11 x 9 1/2 fanfold paper  
at £16.50 per 2000 sheets



GENIE 1 & 2 @ £289+  
VAT — All GENIE mods  
expansion/disks/mem.

CUMANA disk drives at £199 single

and £369 double —  
9" 12MHz monitors for  
only £99+VAT (metal).

OFFICIAL DEALERS FOR:

Nascom, Genie, Cumana, Vic,

and lots more — RING US NOW on  
BERKHAMSTED (04427) 74569 or 5704



VISA

12113 HIGH STREET  
BERKHAMSTED HP4 2HY  
HERTFORDSHIRE



## STOP PRESS

# ZX81

# 16K RAM

NEW LOW PRICE!

# £19.95

FULLY COMPATIBLE, BLACK CASE, GOLD CONNECTOR.

■ ASSEMBLED, TESTED, GUARANTEED. ■

Cheque/P.O.s to:  
PLESSIS ELECTRONICS, CASTLE HOUSE, OLD RD,  
LEIGHTON BUZZARD (beds), LU7 7RG.

PLEASE ADD £1.55 RP

## 14 DAYS DELIVERY

# SPECTRUM ATOM BBC VIC ZX81

MAKE THE MOST OF YOUR MICROCOMPUTER WITH  
OUR POPULAR RANGE OF PROVEN BOOKS —

GETTING ACQUAINTED WITH YOUR ZX81, by Tim Hartwell. Eight  
easy programs in the 128 expert book, including Daughters. **£5.95**

20 SIMPLE ELECTRONIC PROJECTS FOR THE ZX81 and other  
computers by Stephen Adams. **£6.45**

MASTERING MACHINE CODE ON YOUR ZX81 OR ZX80, by Tim  
Hartwell. 150 pages, headless machine code from first principles. **£7.50**

49 EXPLOSIVE GAMES FOR THE ZX81, edited by Tim Hartwell. **£6.95**

34 AMAZING GAMES FOR THE 1K ZX81 by Aubrey Gouther. **£4.95**

THE GATEWAY GUIDE TO THE ZX81 AND ZX80, by Mike  
Charlton. Over 80 programs and routines. ZX BASIC explained in  
detail. **£6.45**

LEARN PASCAL ON ZX81. ZX SPECTRUM ON BBC MICRO-  
COMPUTER WITH PASCAL FOR HUMAN BEINGS, by Jeremy  
Rusden, which contains a 12K computer so you can test a limited version  
of Pascal on your ZX81. ZX Spectrum or BBC Microcomputer. Basic  
introductory editing. **£4.95**

LET YOUR BBC MICRO TEACH YOU TO PROGRAM, by Tim  
Hartwell. Over 40 programs. BBC BASIC from first principles. **£6.45**

THE BBC MICRO REVEALED, by Jeremy Rusden. The full story of  
the BBC Microcomputer for the personal user. **£8.95**

GETTING ACQUAINTED WITH YOUR VIC 20, by Tim Hartwell, with  
over 60 programs to get your VIC up and running from day one. **£6.95**

SYMPHONY FOR A MELANCHOLY COMPUTER, by Tim Hartwell.  
24 generative games. **£6.95**

35 TESTED PROGRAMS FOR THE ACORN ATOM (best introduction  
edited by Tim Hartwell). **£6.45**

GETTING ACQUAINTED WITH YOUR ACORN ATOM, by Trevor  
Shapton and Tim Hartwell. 184 pages. 80 programs, including  
Daughters. **£7.95**

INTERFACE, the monthly magazine published by the NATIONAL  
ZX USERS CLUB is just £3.50/£2.25 (UK/Europe) for 12 issues.  
Sample copy, with many programs for your ZX computer, book  
software and hardware reviews, education, contact addresses  
just £1.

All prices include postage (Spectrum supported) and include VAT.  
All software programs written for your ZX Spectrum.

Please send me the items marked (enclosed C)

Name

Address

Please make cheques payable to INTERFACE and send the above form  
or a reply to: INTERFACE, Dept. PC, 44-46 Earls Court Road,  
London W8 6EJ  
Please allow 20 days for delivery.

# Club Reports

## Watching and waiting in Manchester

*David Kelly reports on the first ZX fair to take place outside London*

Summer may be said to be smiling on Britain now but at traditionally wet Manchester the arrival of the sun cast a shadow over the ZX Microfair.

It was the first such event to be staged outside London. The weather was dazzling and the people stayed away in droves.

As with the last London show, the fair — at the New Century Hall May 29-30 — was spread over two days. There were more than 50 exhibitors and plenty to see, so why was the attendance down to few more than 2,000 for the two days? And why was it that many of the exhibitors commented on the slowness of sales?

Mike Johnston, the ZX Microfair organiser, was able to pinpoint several possible reasons.

The most noticeable feature of the show, he said, was the influence of the Spectrum launch, both on the visitors and the exhibitors.

He was quite pleased with the turnout, particularly on the Saturday, but the uncertainty generated following the Spectrum launch resulted in fewer purchases.

Mike felt the attendance was about right, since the New Century Hall had been chosen to accommodate the sort of numbers that turned up.

When he had been setting up the show in January, he had wanted to include as many local companies as possible. In the event, about one third of the stands represented firms operating in the region.

Rumours of a ZX81 price reduction and uncertainty in the Spectrum delivery dates left most people a little bewildered.

Few exhibitors could be sure of their plans while the Spectrum remained undelivered and the same applied to the buyers.

Mike Johnston is very much aware of the situation. He is going ahead with his next London show, at the New Horticultural Hall in August, but will delay the next regional show, planned probably for Bristol or Southampton, until after the Spectrum is established.

He believes the current mood of dependency cannot last. "People said just the same when the ZX81 was launched — and now look at the number of add-ons and products available for it. Exactly the



Moving in for a closer look... some of the visitors at the Manchester show.



And, at times, jostling for position

same will be true of the Spectrum in a couple of months time."

Of the Manchester show, Mike says: "It seems that anything less than the fantastic success we had in the first London show is regarded as a disaster!"

He did not believe that the response in Manchester would alter his plans for future ZX fairs.

The idea of the fairs has always been to put companies and ZX owners together — and to do so as cheaply as possible. It has been important to keep the entrance fee as low as possible — 60p for adults — and to minimise the expenses to exhibitors.

The cost of a stand at Manchester — £25 — was deliberately kept down to

encourage small businesses which are just beginning to trade.

The next London Show, at the New Horticultural Hall, will last for one day only and in a much bigger venue. The hall has 20,000 sq ft of space, all in one area, so there will be plenty of room for stands and visitors.

Again the show will favour the smaller trader, who will benefit from the lower cost of a one-day event.

Mike hopes that this will result in a show with much interest and variety, but it will be interesting to see what the response from the various ZX businesses will be. Many traders at Manchester had been very disappointed with the attendance and their sales.

The New Horticultural Hall ZX Microfair will be held on Saturday August 31.

For further details contact Mike Johnston, 71 Park Lane, Tottenham, London N17.

## What's happening

**Manchester Acorn User Group** meets fortnightly (during school term time only) on Tuesdays at 7 pm in the Abraham Moss Centre, Coseham. The next meeting will be on June 22. Either telephone (daytime) Barry Pickles on 061-634 1234 or (evening) John Ashurst on 061-881 4962 or write to Barry Pickles, 1 Cromhill Walk, Manchester M13.

**North London BBC Micro Users Group** is being formed. It is hoped that the group will hold fortnightly meetings once a suitable venue has been found. All interested parties and potential members should get in touch with Jeremy Sam, 111 Uphill Road, Mill Hill, London NW7. (Tel: 01-959 0114).

**Crawley ZX81 Users Club** meets every Monday, nearly all the year round (including school holidays) in the Science Laboratory, Iffeld School, Lady Margaret Road, Iffeld, Crawley, Sussex. The club meets between 7 pm and 8 pm. Membership is £11 per year and the first meeting is free. Contact John Haron, Club Secretary, 23 Pelworth Court, Bewbush, Crawley, Sussex. (Tel: 0293 519396).

**Southern Gas Micro Club** is open to any employee of Southern Gas. The club meets at the Southern Gas RHQ, 80 St Mary's Road, Southampton, and has access to ZX81s, a Vic-20, an Acorn Atom and BBC machines. In addition the club produces Microcosm, a newsletter containing club news, reviews and programming hints and articles. Contact Ian Smith, Floor A1, Management Services, Southern Gas RHQ, 80 St Mary's Road, Southampton.

## COVER STORY

## Shark Attack

You are a missile-base commander in the suburbs of Atlanta. Your mission is to destroy as many sharks as possible with your 20 missiles. You command three numbered silos, and choose your firing point via the corresponding keys 1-3.

The shark circles at the top of the screen, on the other side of a strong and unpredictable current. The shark doesn't bite, but dies quite aggressively when hit.

The code-loader program, and the 10 REM (122 K's) are keyed in first and RUN. Next, enter the machine code one byte at a time. The machine code loader will be overrun by the actual program when you key it in, but it is a good idea to SAVE at this point, just in case.

The program uses the whole screen by poking on all the bottom line the status of your missile dump, which decreases as each missile is fired. At the end of the game, your score and a rating are displayed.

The actual machine code is merely a quick-draw subroutine, which I adopted in an effort to speed up my program. I also experimented with true/false equations, which can, as in line 350, take the place of four lines of IF/THEN statements.

If you happen to bob the shark's tail as it approaches from the right, it does not die. This is because the check for a hit in line 430 PEEKs the position directly to the right of the missile when it reached line 1. If

it PEEKs a space, the "death plunge" is avoided.

## Program Listing: "SHARK"

```
10 REM (122 K's)
```

```
20 LET A = 16514
```

```
30 INPUT B
```

```
40 POKE A, B
```

```
50 PRINT B
```

```
60 GOTO 30
```

Machine code

```
16514: 255      183
        6      18636: 52
        0      136      16558: 229
        180     94      20
        84      254     36
        237     0
        61      48
        131     2
        88      24
        42      4
        12      92
        64      0
        75      24
        239     1
        237     36
        91      19
        131     131
        83      46
        26      1
        19      149
        193     280
```

```
1      29
2      0
3      1
4      157
5      1
6      127
7      1
8      1
9      131
10     1
11     130
12     1
13     136
14     30
15     3
16     0
17     1
18     161
19     0
20     1
21     3
22     1
23     0
24     130
25     999
26     999
27     16519: 1
28     999
29     750
30     50 POKE E, 30
31     60 POKE E, 1, 50
32     70 POKE E, 2, 50
33     80 POKE E, 3, 50
34     90 POKE E, 4, 14
```

Actual program: "SHARK"

```
20 LET S = 5
```

```
30 LET B = 19
```

```
40 LET E = (PEEK 16558
```

```
+ 256 * PEEK 16557) +
```

```
750
```

```
50 POKE E, 30
```

```
60 POKE E, 1, 50
```

```
70 POKE E, 2, 50
```

```
80 POKE E, 3, 50
```

```
90 POKE E, 4, 14
```





## by Dave McGuire

```
20 LET A=16514
30 INPUT B
40 POKE A,B
50 PRINT B;";";
60 GOTO 30
70 LET S=0
80 LET T=0
```

170 PRINT AT 21.5, "-----"

```

180 POINT AT 21.0:2
190 LET B=1
200 LET T=0
210 LET T=0
220 IF B=0 THEN GOTO 320
230 IF INKEY$="" THEN GOTO 320
240 LET B=B-1
250 LET T=VAL INKEY$
260 LET H=(T-1)*10+7
270 POKE C=B+H*8
280 FOR V=10 TO 1 STEP -1
290 PRINT AT V:2: TAB 11:PRINT H

```

```

510 PRINT AT U,M,"1"
520 POKE 10510,X
530 RAND USR 10510
540 RAND 0
550 LET X=X+(P*Q)+(X*1)-(X*27)-(
(0=1)

```

```

360 LET P=P-(X*2+1)*X*261
370 LET Y=Y+155
380 IF P=0 THEN LET Y=Y+206
390 POKE 16517,Y
400 IF Y=0 THEN GOTO 220
410 NEXT X
420 PRINT AT U+1,M;" "
430 GOTO 220
440 POKE 16517,225
450 FOR Z=0 TO 255:K=K+1:STEP 33
460 POKE 16518,INT (Z/255)
470 POKE 16519,Z-255:PEEK 16519
480 POKE U+1,16519
490 NEXT Z
500 LET S=S+1000
510 CLS
520 IF S=0 THEN GOTO 50
530 CLS
540 LET C=S/1000
550 IF C=1 THEN PRINT TAB 3;"YOU
560 IF C=1 THEN PRINT TAB 3;"YOU
570 IF C=1 THEN PRINT TAB 3;"YOU
580 IF C=1 THEN PRINT TAB 3;"YOU
590 IF C=0 THEN LET D$="(THE SH
600 IF C=1 THEN LET D$="SHARK S
610 IF C=2 THEN LET D$="TAKES U
620 IF C=3 THEN LET D$="NOT BE
630 IF C=5 THEN LET D$="IF I H
640 IF C=7 THEN LET D$="CAPTAIN
650 IF C=9 THEN LET D$="PODICE
660 IF C=11 THEN LET D$="HAVE
670 IF C=13 THEN LET D$="SHARK
680 IF C=15 THEN LET D$="HAVE
690 IF C=17 THEN LET D$="HORNED
700 IF C=19 THEN LET D$="
710 PRINT
720 IF C=21 THEN LET D$="

```



# Reviews

## hardware



Box of noise... Telesound 82

### Telesound 82

COMPUSOUND, 32 Langley Close,  
Redditch, Worcestershire B98 0ET.  
Tel: 0725-21439.  
Price £89.95 including VAT.

This small metal box sticks on to the back of a ZX81 and enables you to put sounds through your TV speaker. It is connected to the ZX81 by three crocodile clips covered in insulated sleeves, so it can be removed at any time without damaging your ZX81. There is no soldering to be done and no holes to be made in the case.

Once the clips are fitted to the ZX81, the unit may be tested. The audio input to the Telesound 82 is via a 3.5mm jack plug fitted to nine inches of cable. It may be plugged into the output of a tape recorder, soundboard or even the MIC socket of the ZX81.

If you have no sound source then a test program is provided so that the unit can be adjusted with the ZX81 providing the sounds. A program is also included to turn the ZX81 into an electronic organ using the lower two rows of the keyboard.

Telesound 82 will produce sounds through the loudspeaker of a TV set whether or not a program is running. It will also work in FAST or SLOW modes. This can be used to advantage, as a tape giving instructions can be played through the TV, even before the program has been started.

The unit only draws a small current and should not cause any overheating problems with a Sinclair power pack. It does not require any RAM memory to operate and can be used on a 1K or 16K machine.

There were only two problems that I found with Telesound 82. First, the red and black connecting wires were a bit short. If you have one of the larger RAM packs that run along the back of the ZX81, then it could get in the way. Longer leads would

have allowed it to be mounted on the side or the top of the ZX81.

The other problem related to a keyboard bleeder that I have fitted to my ZX81. It also uses the TV Sync signal and the Telesound made this inoperative. I cured this by inserting a 49 ohm resistor in series with the green crocodile clip, allowing both units to work quite happily together.

The unit works best with the sound source volume control on full. Using the TV's volume control to adjust the sound level keeps the background noise down.

### Conclusion

This unit makes games and educational uses of the ZX81 much more interesting. A separate amplifier is no longer necessary, as the TV's sound channel replaces it. The instructions are clear and easy to follow.

The two programs included with the kit are a FAST mode electronic organ routine and a short test program. Telesound 82 is excellent value for money and, I believe, the only one on the market. **SA**

### RD system

RD Laboratories, 5 Kennedy Road, Dane End, Ware, Hertfordshire SG12 0LU. Tel: 0900 84380.

Prices: RD8100 £40; RD8101 £15; RD8110 £27.50.

The simplest RD system consists of an RD8101 micro-mum and an RD8110 eight bit input/output port. The motherboard is different from most in that it consists of 0.1mm spaced pins which stick up from the motherboard in two parallel rows. There is space for two modules on the RD8101, one on each row of pins.

If more modules are required, RD make the RD8100 which is an eight row motherboard in a case. This large motherboard has several advantages over the simple printed circuit board of the micro-mum. It is contained in a black plastic box, slipped towards you, and is fully buffered which means that there are chips built into the box to amplify the signals coming from the ZX80 or ZX81. This buffering allows the modules attached to the motherboard to be removed at any time without crashing the ZX computer.

The 16K RAM pack and printer can be connected to the back of either motherboard, so that any modules that you wish to use can also be connected here. An extra power supply for the motherboard can be plugged in to a power socket at the back, to relieve the strain on the ZX81's own 5 volt regulator.

The RD8110 provides eight input wires and eight output wires of a memory mapped port which can be used in a variety of

ways. This port is one of the few that is fully decoded, so that it occupies one address and can be treated like a piece of RAM.

The address of the port can be set to one of 16 addresses between 16552 and 16567 by inserting a wire in a five pin socket on the underside of the module. The connections to the port can be made in two ways, by poking bare wire into the sockets on top of the module or by plugging in easily available 0.1mm Molex pinned blocks. No soldering is required.

The booklet that accompanies each part of the system explains what you can do with the port, from using a 64 key keyboard to a remote testing facility.

The RD8100 is, I believe, a very good system for the experimenter or for school. You can add as many modules as you require and it does not take an electronics genius to use them. **SA**

### Info and Data

By Barbara and John Jeworski, published by Nelson, 206 pages, paperback. Price £3.95.

Every user of a home computer comes to the time when he or she wants to learn more about computers. When the games pall or the struggles at unstructured programming cease, relax in a chair with this excellent background book.

Computers: Information and Data was written specifically for school and college use, but do not let that put you off. For one thing, text-books are a good starting point for picking up a basic knowledge of almost any field. Also, this book is the best CSE Ordinary level computing text-book that I have come across, and is certainly tougher going than some, and has few pictures, but it covers the material carefully and thoroughly.

One point to note is that this book does not include material on programming. This is normal educational practice — different people have different approaches to programming and different machines to program. For similar reasons the authors do not cover the history, logic and social impact of computers.

There are chapters on the nature of the digital machine, data, storage, files, hardware, software, systems analysis, programming approaches, processing and applications. The book has plenty of examples and exercises, and the index is excellent.

In every way this is a most useful book whether you are interested in computers for personal or educational reasons. And it comes at a school-book price — good value in other words. **KU**

# Reviews

## software

### ZXAS

Big-Byte Software, 96-100 The Albany,  
Old Hall Street, Liverpool  
ZX81 16K cassette  
Price £5.00

ZXAS is an assembler for the 16K ZX81, which is written in machine code. The program is 5K long and when run relocates itself in the top five k of ram and reduces RAMTOP by five k. A small BASIC portion of the program inputs the start location of the machine code and calls the assembler.

Standard Zilog mnemonics are used, with the exception of commas which are replaced by full stops. If the operations are separated by semicolons, more than one can be placed in the REM statements which hold the object code. However, this can make debugging a bit harder.

Two hundred and fifty-six labels are allowed, imaginatively called L0 to L255. These are distinguished by placing a colon before them. The assembler is two-pass and jumps using labels are calculated on the second pass.

The assembler works extremely quickly assembling 20 instructions as the screen is displayed, which takes less than one second. The operation codes and locations in hex are displayed, along with the mnemonics and the codes original REM statement.

The program seems bug-free and only has one minor fault. This is the lack of a routine to save assembled code on to tape, unless the code is first put in a REM statement.

The program loads well in about two and a half minutes. But the coding on my copy was slightly distorted, so it has to be pressed firmly into the recorder. This could cause some tape problems, but the tape itself sounds OK.

#### Summary

A well-thought-out product, which is useful to anyone who is seriously interested in machine-code programming on the ZX81.

AE

### Fun To Learn

Available from W H Smith branches, or direct from Sinclair Research, Freeport, Camberley, Surrey GU15 3BR.  
ZX81 16K cassette.  
Price £6.95

If you go into your local W H Smith, you will see the sombre brown and yellow stripes of the ICL 'Fun To Learn' series of software. There are 6 of these tapes, and

they form a large part of Sinclair's latest releases of software for the ZX81. The tapes are:

- E1: English Literature 1 and 2
- E2: Geography
- E3: History
- E4: Mathematics
- E5: Music
- E7: Inventions
- E8: Spelling

Most of these programs take the form of a race between 1 to 4 people, with a menu of about half a dozen categories within the main subject. For instance, the History program will give you the choice of answering questions on, among others, 'Monarchs of Britain', 'When Did He Reign' and 'Roll Luck'.

Questions of 'Roll Luck' Questions are then set with multiple-choice answers. There is also a teaching mode in some subjects, in which the computer runs through salient points of the subject, with clues and various other informative notes.

The Geography program is designed for one person only, and displays a map of England or Europe. The user then answers questions about the towns of England, or the countries and capitals of Europe. The computer will also run through the locations of those on the map, in the teaching mode.

Mathematics consists of levels in each of the four basic operations, of addition, subtraction, multiplication and division.

Spelling is a test for 6- to 11-year-olds. Sentences are spoken, and words within that sentence tested. The correct spelling will then appear, and the pupil goes on to the next sentence.

#### Summary

Attractively based and easily loaded, the programs are, however, slightly over-priced. Many of the programs share the same basic algorithm. Even though expert knowledge must have been sought to set the questions, the duplication of programs should have brought the price down by a pound or two.

The questions are fairly difficult, and would probably appeal more to older teenagers and adults when used as a General Knowledge Quiz rather than in a strictly classroom environment.

It must be admitted, however, that younger children recognise even the harder questions as they come round for the fourth or fifth time. Unfortunately there is no feedback to refer back to and gain further knowledge. Having learnt that disc brakes were invented in 1902, but were not in general use until 1960, it would be nice to know why.

Spelling mistakes occur occasionally, but are probably due to careless typing. There are one or two more serious mistakes, such as Sir Arthur Bliss's inclusion

in the section on Opera, when Bliss did not write any Operas.

ICL's next addition to their educational range should be a Modular program that would enable the users to set their own questions — there being only a limited amount of data in existing programs.

AB

### A-maz-ing Vic Pack

Audiogenic Ltd, PO Box 88, 34-36 Crown Street, Reading.  
WQ20 3K cassette  
Price £6.95 (including VAT)

A-maz-ing is yet another version of the Pac-Man arcade game. The Gobbler wanders around a maze, side-swiping unfriendly ghosts and eating lots of life dots. Quite where it puts them is hard to discover — it is obviously one of those voracious creatures that can eat its own weight several times over.

In the US the original Atari arcade version costed over \$1 billion in its first year. But, on the strength of this Audiogenic version, it is hard to see why.

The major disadvantage of A-maz-ing is that it soon becomes a walkover. When the program first runs everything is fine. After a short while, however, the Gobbler becomes rather easy to control, particularly when using the joystick option.

Another problem is that the ghosts do not seem that unfriendly. They prefer to remain somewhat still and are not terribly bothered by the ravenous Gobbler. You can quite happily sneak up behind a ghost and thump the binto three, so long as the knowledge that the ghost will take some time to turn round.

The game does, however, contain all the features of the original. If you are unlucky enough to be cornered by a ghost, you have no hope and must forfeit one of your three lives.

But, you can turn the tables on the ghosts by eating one of the four power dots in the maze. This sounds a tone and causes the ghosts to change colour. It is then possible to eat the ghosts, until the power runs out and the ghosts revert to their normal colours.

The more blobs you eat, the more points you are awarded, with bonuses for swallowing power dots or ghosts.

Basic instructions and the key-board controls are explained on the insert supplied with the cassette.

#### Summary

The Vic-Pack version is a little short of A-maz-ing, but it is undoubtedly appeal to Pac-Man enthusiasts.

DK

# Open Forum

*Open Forum is for you to publish your programs and ideas. It is important that your programs are bug free before you send them in. We cannot test all of them. Contributions should be sent to: Popular Computing Weekly, Hobbouse Court, 19 Whitcomb Street, London WC2H 7HF.*

## How to contribute

Each week the editor goes through all the programs that you send to Open Forum in order to find the Program of the Week.

The author of that program will qualify for DOUBLE the usual fee we pay for published programs.

(The usual fee is £10.)

### Presentation hints

Programs which are most likely to be considered for the Program of the Week will be computer printed and accompanied by a cassette.

The program will be well documented, the documentation being typed with a double spacing between each line.

The documentation should start with a general description of the program and then give some detail of how the program has been constructed and of its special features.

Listings taken from a ZX Printer should be cut into convenient lengths and carefully stuck down on to white paper, avoiding any creasing.

Please enclose a stamped, self-addressed envelope.

## Ski run

on BBC Micro

The object of the game is to manoeuvre your skier to the "X" in the bottom right hand corner of the screen without hitting any of the trees. If you miss the "X" at the bottom of the screen, you restart at the top of the ski slope automatically.

One point to note is that if you hold down the "Q" key to move left, or the "B" key to move right, your speed increases. But this is not a disadvantage once you have mastered the game.

## Dec binary conversion

on Visi-80

A simple program which uses two loops to convert decimal to binary. The first loop

to next page

Ski run  
by Alan Wood

```

1000000
2000000-82880-810-8
3000000
4000000-82880-810-8
5000000-82880-810-8
6000000-82880-810-8
7000000-82880-810-8
8000000-82880-810-8
9000000-82880-810-8
10000000-82880-810-8
11000000-82880-810-8
12000000-82880-810-8
13000000-82880-810-8
14000000-82880-810-8
15000000-82880-810-8
16000000-82880-810-8
17000000-82880-810-8
18000000-82880-810-8
19000000-82880-810-8
20000000-82880-810-8
21000000-82880-810-8
22000000-82880-810-8
23000000-82880-810-8
24000000-82880-810-8
25000000-82880-810-8
26000000-82880-810-8
27000000-82880-810-8
28000000-82880-810-8
29000000-82880-810-8
30000000-82880-810-8
31000000-82880-810-8
32000000-82880-810-8
33000000-82880-810-8
34000000-82880-810-8
35000000-82880-810-8
36000000-82880-810-8
37000000-82880-810-8
38000000-82880-810-8
39000000-82880-810-8
40000000-82880-810-8
41000000-82880-810-8
42000000-82880-810-8
43000000-82880-810-8
44000000-82880-810-8
45000000-82880-810-8
46000000-82880-810-8
47000000-82880-810-8
48000000-82880-810-8
49000000-82880-810-8
50000000-82880-810-8
51000000-82880-810-8
52000000-82880-810-8
53000000-82880-810-8
54000000-82880-810-8
55000000-82880-810-8
56000000-82880-810-8
57000000-82880-810-8
58000000-82880-810-8
59000000-82880-810-8
60000000-82880-810-8
61000000-82880-810-8
62000000-82880-810-8
63000000-82880-810-8
64000000-82880-810-8
65000000-82880-810-8
66000000-82880-810-8
67000000-82880-810-8
68000000-82880-810-8
69000000-82880-810-8
70000000-82880-810-8
71000000-82880-810-8
72000000-82880-810-8
73000000-82880-810-8
74000000-82880-810-8
75000000-82880-810-8
76000000-82880-810-8
77000000-82880-810-8
78000000-82880-810-8
79000000-82880-810-8
80000000-82880-810-8
81000000-82880-810-8
82000000-82880-810-8
83000000-82880-810-8
84000000-82880-810-8
85000000-82880-810-8
86000000-82880-810-8
87000000-82880-810-8
88000000-82880-810-8
89000000-82880-810-8
90000000-82880-810-8
91000000-82880-810-8
92000000-82880-810-8
93000000-82880-810-8
94000000-82880-810-8
95000000-82880-810-8
96000000-82880-810-8
97000000-82880-810-8
98000000-82880-810-8
99000000-82880-810-8
100000000-82880-810-8
101000000-82880-810-8
102000000-82880-810-8
103000000-82880-810-8
104000000-82880-810-8
105000000-82880-810-8
106000000-82880-810-8
107000000-82880-810-8
108000000-82880-810-8
109000000-82880-810-8
110000000-82880-810-8
111000000-82880-810-8
112000000-82880-810-8
113000000-82880-810-8
114000000-82880-810-8
115000000-82880-810-8
116000000-82880-810-8
117000000-82880-810-8
118000000-82880-810-8
119000000-82880-810-8
120000000-82880-810-8
121000000-82880-810-8
122000000-82880-810-8
123000000-82880-810-8
124000000-82880-810-8
125000000-82880-810-8
126000000-82880-810-8
127000000-82880-810-8
128000000-82880-810-8
129000000-82880-810-8
130000000-82880-810-8
131000000-82880-810-8
132000000-82880-810-8
133000000-82880-810-8
134000000-82880-810-8
135000000-82880-810-8
136000000-82880-810-8
137000000-82880-810-8
138000000-82880-810-8
139000000-82880-810-8
140000000-82880-810-8
141000000-82880-810-8
142000000-82880-810-8
143000000-82880-810-8
144000000-82880-810-8
145000000-82880-810-8
146000000-82880-810-8
147000000-82880-810-8
148000000-82880-810-8
149000000-82880-810-8
150000000-82880-810-8
151000000-82880-810-8
152000000-82880-810-8
153000000-82880-810-8
154000000-82880-810-8
155000000-82880-810-8
156000000-82880-810-8
157000000-82880-810-8
158000000-82880-810-8
159000000-82880-810-8
160000000-82880-810-8
161000000-82880-810-8
162000000-82880-810-8
163000000-82880-810-8
164000000-82880-810-8
165000000-82880-810-8
166000000-82880-810-8
167000000-82880-810-8
168000000-82880-810-8
169000000-82880-810-8
170000000-82880-810-8
171000000-82880-810-8
172000000-82880-810-8
173000000-82880-810-8
174000000-82880-810-8
175000000-82880-810-8
176000000-82880-810-8
177000000-82880-810-8
178000000-82880-810-8
179000000-82880-810-8
180000000-82880-810-8
181000000-82880-810-8
182000000-82880-810-8
183000000-82880-810-8
184000000-82880-810-8
185000000-82880-810-8
186000000-82880-810-8
187000000-82880-810-8
188000000-82880-810-8
189000000-82880-810-8
190000000-82880-810-8
191000000-82880-810-8
192000000-82880-810-8
193000000-82880-810-8
194000000-82880-810-8
195000000-82880-810-8
196000000-82880-810-8
197000000-82880-810-8
198000000-82880-810-8
199000000-82880-810-8
200000000-82880-810-8
201000000-82880-810-8
202000000-82880-810-8
203000000-82880-810-8
204000000-82880-810-8
205000000-82880-810-8
206000000-82880-810-8
207000000-82880-810-8
208000000-82880-810-8
209000000-82880-810-8
210000000-82880-810-8
211000000-82880-810-8
212000000-82880-810-8
213000000-82880-810-8
214000000-82880-810-8
215000000-82880-810-8
216000000-82880-810-8
217000000-82880-810-8
218000000-82880-810-8
219000000-82880-810-8
220000000-82880-810-8
221000000-82880-810-8
222000000-82880-810-8
223000000-82880-810-8
224000000-82880-810-8
225000000-82880-810-8
226000000-82880-810-8
227000000-82880-810-8
228000000-82880-810-8
229000000-82880-810-8
230000000-82880-810-8
231000000-82880-810-8
232000000-82880-810-8
233000000-82880-810-8
234000000-82880-810-8
235000000-82880-810-8
236000000-82880-810-8
237000000-82880-810-8
238000000-82880-810-8
239000000-82880-810-8
240000000-82880-810-8
241000000-82880-810-8
242000000-82880-810-8
243000000-82880-810-8
244000000-82880-810-8
245000000-82880-810-8
246000000-82880-810-8
247000000-82880-810-8
248000000-82880-810-8
249000000-82880-810-8
250000000-82880-810-8
251000000-82880-810-8
252000000-82880-810-8
253000000-82880-810-8
254000000-82880-810-8
255000000-82880-810-8
256000000-82880-810-8
257000000-82880-810-8
258000000-82880-810-8
259000000-82880-810-8
260000000-82880-810-8
261000000-82880-810-8
262000000-82880-810-8
263000000-82880-810-8
264000000-82880-810-8
265000000-82880-810-8
266000000-82880-810-8
267000000-82880-810-8
268000000-82880-810-8
269000000-82880-810-8
270000000-82880-810-8
271000000-82880-810-8
272000000-82880-810-8
273000000-82880-810-8
274000000-82880-810-8
275000000-82880-810-8
276000000-82880-810-8
277000000-82880-810-8
278000000-82880-810-8
279000000-82880-810-8
280000000-82880-810-8
281000000-82880-810-8
282000000-82880-810-8
283000000-82880-810-8
284000000-82880-810-8
285000000-82880-810-8
286000000-82880-810-8
287000000-82880-810-8
288000000-82880-810-8
289000000-82880-810-8
290000000-82880-810-8
291000000-82880-810-8
292000000-82880-810-8
293000000-82880-810-8
294000000-82880-810-8
295000000-82880-810-8
296000000-82880-810-8
297000000-82880-810-8
298000000-82880-810-8
299000000-82880-810-8
300000000-82880-810-8
301000000-82880-810-8
302000000-82880-810-8
303000000-82880-810-8
304000000-82880-810-8
305000000-82880-810-8
306000000-82880-810-8
307000000-82880-810-8
308000000-82880-810-8
309000000-82880-810-8
310000000-82880-810-8
311000000-82880-810-8
312000000-82880-810-8
313000000-82880-810-8
314000000-82880-810-8
315000000-82880-810-8
316000000-82880-810-8
317000000-82880-810-8
318000000-82880-810-8
319000000-82880-810-8
320000000-82880-810-8
321000000-82880-810-8
322000000-82880-810-8
323000000-82880-810-8
324000000-82880-810-8
325000000-82880-810-8
326000000-82880-810-8
327000000-82880-810-8
328000000-82880-810-8
329000000-82880-810-8
330000000-82880-810-8
331000000-82880-810-8
332000000-82880-810-8
333000000-82880-810-8
334000000-82880-810-8
335000000-82880-810-8
336000000-82880-810-8
337000000-82880-810-8
338000000-82880-810-8
339000000-82880-810-8
340000000-82880-810-8
341000000-82880-810-8
342000000-82880-810-8
343000000-82880-810-8
344000000-82880-810-8
345000000-82880-810-8
346000000-82880-810-8
347000000-82880-810-8
348000000-82880-810-8
349000000-82880-810-8
350000000-82880-810-8
351000000-82880-810-8
352000000-82880-810-8
353000000-82880-810-8
354000000-82880-810-8
355000000-82880-810-8
356000000-82880-810-8
357000000-82880-810-8
358000000-82880-810-8
359000000-82880-810-8
360000000-82880-810-8
361000000-82880-810-8
362000000-82880-810-8
363000000-82880-810-8
364000000-82880-810-8
365000000-82880-810-8
366000000-82880-810-8
367000000-82880-810-8
368000000-82880-810-8
369000000-82880-810-8
370000000-82880-810-8
371000000-82880-810-8
372000000-82880-810-8
373000000-82880-810-8
374000000-82880-810-8
375000000-82880-810-8
376000000-82880-810-8
377000000-82880-810-8
378000000-82880-810-8
379000000-82880-810-8
380000000-82880-810-8
381000000-82880-810-8
382000000-82880-810-8
383000000-82880-810-8
384000000-82880-810-8
385000000-82880-810-8
386000000-82880-810-8
387000000-82880-810-8
388000000-82880-810-8
389000000-82880-810-8
390000000-82880-810-8
391000000-82880-810-8
392000000-82880-810-8
393000000-82880-810-8
394000000-82880-810-8
395000000-82880-810-8
396000000-82880-810-8
397000000-82880-810-8
398000000-82880-810-8
399000000-82880-810-8
400000000-82880-810-8
401000000-82880-810-8
402000000-82880-810-8
403000000-82880-810-8
404000000-82880-810-8
405000000-82880-810-8
406000000-82880-810-8
407000000-82880-810-8
408000000-82880-810-8
409000000-82880-810-8
410000000-82880-810-8
411000000-82880-810-8
412000000-82880-810-8
413000000-82880-810-8
414000000-82880-810-8
415000000-82880-810-8
416000000-82880-810-8
417000000-82880-810-8
418000000-82880-810-8
419000000-82880-810-8
420000000-82880-810-8
421000000-82880-810-8
422000000-82880-810-8
423000000-82880-810-8
424000000-82880-810-8
425000000-82880-810-8
426000000-82880-810-8
427000000-82880-810-8
428000000-82880-810-8
429000000-82880-810-8
430000000-82880-810-8
431000000-82880-810-8
432000000-82880-810-8
433000000-82880-810-8
434000000-82880-810-8
435000000-82880-810-8
436000000-82880-810-8
437000000-82880-810-8
438000000-82880-810-8
439000000-82880-810-8
440000000-82880-810-8
441000000-82880-810-8
442000000-82880-810-8
443000000-82880-810-8
444000000-82880-810-8
445000000-82880-810-8
446000000-82880-810-8
447000000-82880-810-8
448000000-82880-810-8
449000000-82880-810-8
450000000-82880-810-8
451000000-82880-810-8
452000000-82880-810-8
453000000-82880-810-8
454000000-82880-810-8
455000000-82880-810-8
456000000-82880-810-8
457000000-82880-810-8
458000000-82880-810-8
459000000-82880-810-8
460000000-82880-810-8
461000000-82880-810-8
462000000-82880-810-8
463000000-82880-810-8
464000000-82880-810-8
465000000-82880-810-8
466000000-82880-810-8
467000000-82880-810-8
468000000-82880-810-8
469000000-82880-810-8
470000000-82880-810-8
471000000-82880-810-8
472000000-82880-810-8
473000000-82880-810-8
474000000-82880-810-8
475000000-82880-810-8
476000000-82880-810-8
477000000-82880-810-8
478000000-82880-810-8
479000000-82880-810-8
480000000-82880-810-8
481000000-82880-810-8
482000000-82880-810-8
483000000-82880-810-8
484000000-82880-810-8
485000000-82880-810-8
486000000-82880-810-8
487000000-82880-810-8
488000000-82880-810-8
489000000-82880-810-8
490000000-82880-810-8
491000000-82880-810-8
492000000-82880-810-8
493000000-82880-810-8
494000000-82880-810-8
495000000-82880-810-8
496000000-82880-810-8
497000000-82880-810-8
498000000-82880-810-8
499000000-82880-810-8
500000000-82880-810-8
501000000-82880-810-8
502000000-82880-810-8
503000000-82880-810-8
504000000-82880-810-8
505000000-82880-810-8
506000000-82880-810-8
507000000-82880-810-8
508000000-82880-810-8
509000000-82880-810-8
510000000-82880-810-8
511000000-82880-810-8
512000000-82880-810-8
513000000-82880-810-8
514000000-82880-810-8
515000000-82880-810-8
516000000
```

# Open Forum

from previous page

finds the position of the most significant bit while the second loop works out the remaining least significant bits.

## Big letters

on Vio-20

The program scrolls a message of the user's choice up the screen in large 8x8 letters. Here's how it works:

Lines 6 to 4 print the instructions.  
Lines 5 to 7 input the message entered at the top of the screen and set up the variables.  
Line 8 shifts the screen cursor of the message into an array and sets the print position to the centre of the screen.  
Lines 9 to 122 PEEK the character generator, convert the number to binary and then to a series of inverse spaces which make up the characters.

```

100 GOTO LEAVING ZERO  IF: NO1 DISPLAYED
110 GOTO 1
120 GOTO 1
130 INPUT ENTER MESSAGE
140 IF NO1 THEN END
150 GOTO 1
160 GOTO 1
170 GOTO 1
180 GOTO 1
190 GOTO 1
200 GOTO 1
210 GOTO 1
220 GOTO 1
230 GOTO 1
240 GOTO 1
250 GOTO 1
260 GOTO 1
270 GOTO 1
280 GOTO 1
290 GOTO 1
300 GOTO 1
310 GOTO 1
320 GOTO 1
330 GOTO 1
340 GOTO 1
350 GOTO 1
360 GOTO 1
370 GOTO 1
380 GOTO 1
390 GOTO 1
400 GOTO 1
410 GOTO 1
420 GOTO 1
430 GOTO 1
440 GOTO 1
450 GOTO 1
460 GOTO 1
470 GOTO 1
480 GOTO 1
490 GOTO 1
500 GOTO 1
510 GOTO 1
520 GOTO 1
530 GOTO 1
540 GOTO 1
550 GOTO 1
560 GOTO 1
570 GOTO 1
580 GOTO 1
590 GOTO 1
600 GOTO 1
610 GOTO 1
620 GOTO 1
630 GOTO 1
640 GOTO 1
650 GOTO 1
660 GOTO 1
670 GOTO 1
680 GOTO 1
690 GOTO 1
700 GOTO 1
710 GOTO 1
720 GOTO 1
730 GOTO 1
740 GOTO 1
750 GOTO 1
760 GOTO 1
770 GOTO 1
780 GOTO 1
790 GOTO 1
800 GOTO 1
810 GOTO 1
820 GOTO 1
830 GOTO 1
840 GOTO 1
850 GOTO 1
860 GOTO 1
870 GOTO 1
880 GOTO 1
890 GOTO 1
900 GOTO 1
910 GOTO 1
920 GOTO 1
930 GOTO 1
940 GOTO 1
950 GOTO 1
960 GOTO 1
970 GOTO 1
980 GOTO 1
990 GOTO 1
1000 GOTO 1
1010 GOTO 1
1020 GOTO 1
1030 GOTO 1
1040 GOTO 1
1050 GOTO 1
1060 GOTO 1
1070 GOTO 1
1080 GOTO 1
1090 GOTO 1
1100 GOTO 1
1110 GOTO 1
1120 GOTO 1
1130 GOTO 1
1140 GOTO 1
1150 GOTO 1
1160 GOTO 1
1170 GOTO 1
1180 GOTO 1
1190 GOTO 1
1200 GOTO 1
1210 GOTO 1
1220 GOTO 1
1230 GOTO 1
1240 GOTO 1
1250 GOTO 1
1260 GOTO 1
1270 GOTO 1
1280 GOTO 1
1290 GOTO 1
1300 GOTO 1
1310 GOTO 1
1320 GOTO 1
1330 GOTO 1
1340 GOTO 1
1350 GOTO 1
1360 GOTO 1
1370 GOTO 1
1380 GOTO 1
1390 GOTO 1
1400 GOTO 1
1410 GOTO 1
1420 GOTO 1
1430 GOTO 1
1440 GOTO 1
1450 GOTO 1
1460 GOTO 1
1470 GOTO 1
1480 GOTO 1
1490 GOTO 1
1500 GOTO 1
1510 GOTO 1
1520 GOTO 1
1530 GOTO 1
1540 GOTO 1
1550 GOTO 1
1560 GOTO 1
1570 GOTO 1
1580 GOTO 1
1590 GOTO 1
1600 GOTO 1
1610 GOTO 1
1620 GOTO 1
1630 GOTO 1
1640 GOTO 1
1650 GOTO 1
1660 GOTO 1
1670 GOTO 1
1680 GOTO 1
1690 GOTO 1
1700 GOTO 1
1710 GOTO 1
1720 GOTO 1
1730 GOTO 1
1740 GOTO 1
1750 GOTO 1
1760 GOTO 1
1770 GOTO 1
1780 GOTO 1
1790 GOTO 1
1800 GOTO 1
1810 GOTO 1
1820 GOTO 1
1830 GOTO 1
1840 GOTO 1
1850 GOTO 1
1860 GOTO 1
1870 GOTO 1
1880 GOTO 1
1890 GOTO 1
1900 GOTO 1
1910 GOTO 1
1920 GOTO 1
1930 GOTO 1
1940 GOTO 1
1950 GOTO 1
1960 GOTO 1
1970 GOTO 1
1980 GOTO 1
1990 GOTO 1
2000 GOTO 1
2010 GOTO 1
2020 GOTO 1
2030 GOTO 1
2040 GOTO 1
2050 GOTO 1
2060 GOTO 1
2070 GOTO 1
2080 GOTO 1
2090 GOTO 1
2100 GOTO 1
2110 GOTO 1
2120 GOTO 1
2130 GOTO 1
2140 GOTO 1
2150 GOTO 1
2160 GOTO 1
2170 GOTO 1
2180 GOTO 1
2190 GOTO 1
2200 GOTO 1
2210 GOTO 1
2220 GOTO 1
2230 GOTO 1
2240 GOTO 1
2250 GOTO 1
2260 GOTO 1
2270 GOTO 1
2280 GOTO 1
2290 GOTO 1
2300 GOTO 1
2310 GOTO 1
2320 GOTO 1
2330 GOTO 1
2340 GOTO 1
2350 GOTO 1
2360 GOTO 1
2370 GOTO 1
2380 GOTO 1
2390 GOTO 1
2400 GOTO 1
2410 GOTO 1
2420 GOTO 1
2430 GOTO 1
2440 GOTO 1
2450 GOTO 1
2460 GOTO 1
2470 GOTO 1
2480 GOTO 1
2490 GOTO 1
2500 GOTO 1
2510 GOTO 1
2520 GOTO 1
2530 GOTO 1
2540 GOTO 1
2550 GOTO 1
2560 GOTO 1
2570 GOTO 1
2580 GOTO 1
2590 GOTO 1
2600 GOTO 1
2610 GOTO 1
2620 GOTO 1
2630 GOTO 1
2640 GOTO 1
2650 GOTO 1
2660 GOTO 1
2670 GOTO 1
2680 GOTO 1
2690 GOTO 1
2700 GOTO 1
2710 GOTO 1
2720 GOTO 1
2730 GOTO 1
2740 GOTO 1
2750 GOTO 1
2760 GOTO 1
2770 GOTO 1
2780 GOTO 1
2790 GOTO 1
2800 GOTO 1
2810 GOTO 1
2820 GOTO 1
2830 GOTO 1
2840 GOTO 1
2850 GOTO 1
2860 GOTO 1
2870 GOTO 1
2880 GOTO 1
2890 GOTO 1
2900 GOTO 1
2910 GOTO 1
2920 GOTO 1
2930 GOTO 1
2940 GOTO 1
2950 GOTO 1
2960 GOTO 1
2970 GOTO 1
2980 GOTO 1
2990 GOTO 1
3000 GOTO 1
3010 GOTO 1
3020 GOTO 1
3030 GOTO 1
3040 GOTO 1
3050 GOTO 1
3060 GOTO 1
3070 GOTO 1
3080 GOTO 1
3090 GOTO 1
3100 GOTO 1
3110 GOTO 1
3120 GOTO 1
3130 GOTO 1
3140 GOTO 1
3150 GOTO 1
3160 GOTO 1
3170 GOTO 1
3180 GOTO 1
3190 GOTO 1
3200 GOTO 1
3210 GOTO 1
3220 GOTO 1
3230 GOTO 1
3240 GOTO 1
3250 GOTO 1
3260 GOTO 1
3270 GOTO 1
3280 GOTO 1
3290 GOTO 1
3300 GOTO 1
3310 GOTO 1
3320 GOTO 1
3330 GOTO 1
3340 GOTO 1
3350 GOTO 1
3360 GOTO 1
3370 GOTO 1
3380 GOTO 1
3390 GOTO 1
3400 GOTO 1
3410 GOTO 1
3420 GOTO 1
3430 GOTO 1
3440 GOTO 1
3450 GOTO 1
3460 GOTO 1
3470 GOTO 1
3480 GOTO 1
3490 GOTO 1
3500 GOTO 1
3510 GOTO 1
3520 GOTO 1
3530 GOTO 1
3540 GOTO 1
3550 GOTO 1
3560 GOTO 1
3570 GOTO 1
3580 GOTO 1
3590 GOTO 1
3600 GOTO 1
3610 GOTO 1
3620 GOTO 1
3630 GOTO 1
3640 GOTO 1
3650 GOTO 1
3660 GOTO 1
3670 GOTO 1
3680 GOTO 1
3690 GOTO 1
3700 GOTO 1
3710 GOTO 1
3720 GOTO 1
3730 GOTO 1
3740 GOTO 1
3750 GOTO 1
3760 GOTO 1
3770 GOTO 1
3780 GOTO 1
3790 GOTO 1
3800 GOTO 1
3810 GOTO 1
3820 GOTO 1
3830 GOTO 1
3840 GOTO 1
3850 GOTO 1
3860 GOTO 1
3870 GOTO 1
3880 GOTO 1
3890 GOTO 1
3900 GOTO 1
3910 GOTO 1
3920 GOTO 1
3930 GOTO 1
3940 GOTO 1
3950 GOTO 1
3960 GOTO 1
3970 GOTO 1
3980 GOTO 1
3990 GOTO 1
4000 GOTO 1
4010 GOTO 1
4020 GOTO 1
4030 GOTO 1
4040 GOTO 1
4050 GOTO 1
4060 GOTO 1
4070 GOTO 1
4080 GOTO 1
4090 GOTO 1
4100 GOTO 1
4110 GOTO 1
4120 GOTO 1
4130 GOTO 1
4140 GOTO 1
4150 GOTO 1
4160 GOTO 1
4170 GOTO 1
4180 GOTO 1
4190 GOTO 1
4200 GOTO 1
4210 GOTO 1
4220 GOTO 1
4230 GOTO 1
4240 GOTO 1
4250 GOTO 1
4260 GOTO 1
4270 GOTO 1
4280 GOTO 1
4290 GOTO 1
4300 GOTO 1
4310 GOTO 1
4320 GOTO 1
4330 GOTO 1
4340 GOTO 1
4350 GOTO 1
4360 GOTO 1
4370 GOTO 1
4380 GOTO 1
4390 GOTO 1
4400 GOTO 1
4410 GOTO 1
4420 GOTO 1
4430 GOTO 1
4440 GOTO 1
4450 GOTO 1
4460 GOTO 1
4470 GOTO 1
4480 GOTO 1
4490 GOTO 1
4500 GOTO 1
4510 GOTO 1
4520 GOTO 1
4530 GOTO 1
4540 GOTO 1
4550 GOTO 1
4560 GOTO 1
4570 GOTO 1
4580 GOTO 1
4590 GOTO 1
4600 GOTO 1
4610 GOTO 1
4620 GOTO 1
4630 GOTO 1
4640 GOTO 1
4650 GOTO 1
4660 GOTO 1
4670 GOTO 1
4680 GOTO 1
4690 GOTO 1
4700 GOTO 1
4710 GOTO 1
4720 GOTO 1
4730 GOTO 1
4740 GOTO 1
4750 GOTO 1
4760 GOTO 1
4770 GOTO 1
4780 GOTO 1
4790 GOTO 1
4800 GOTO 1
4810 GOTO 1
4820 GOTO 1
4830 GOTO 1
4840 GOTO 1
4850 GOTO 1
4860 GOTO 1
4870 GOTO 1
4880 GOTO 1
4890 GOTO 1
4900 GOTO 1
4910 GOTO 1
4920 GOTO 1
4930 GOTO 1
4940 GOTO 1
4950 GOTO 1
4960 GOTO 1
4970 GOTO 1
4980 GOTO 1
4990 GOTO 1
5000 GOTO 1
5010 GOTO 1
5020 GOTO 1
5030 GOTO 1
5040 GOTO 1
5050 GOTO 1
5060 GOTO 1
5070 GOTO 1
5080 GOTO 1
5090 GOTO 1
5100 GOTO 1
5110 GOTO 1
5120 GOTO 1
5130 GOTO 1
5140 GOTO 1
5150 GOTO 1
5160 GOTO 1
5170 GOTO 1
5180 GOTO 1
5190 GOTO 1
5200 GOTO 1
5210 GOTO 1
5220 GOTO 1
5230 GOTO 1
5240 GOTO 1
5250 GOTO 1
5260 GOTO 1
5270 GOTO 1
5280 GOTO 1
5290 GOTO 1
5300 GOTO 1
5310 GOTO 1
5320 GOTO 1
5330 GOTO 1
5340 GOTO 1
5350 GOTO 1
5360 GOTO 1
5370 GOTO 1
5380 GOTO 1
5390 GOTO 1
5400 GOTO 1
5410 GOTO 1
5420 GOTO 1
5430 GOTO 1
5440 GOTO 1
5450 GOTO 1
5460 GOTO 1
5470 GOTO 1
5480 GOTO 1
5490 GOTO 1
5500 GOTO 1
5510 GOTO 1
5520 GOTO 1
5530 GOTO 1
5540 GOTO 1
5550 GOTO 1
5560 GOTO 1
5570 GOTO 1
5580 GOTO 1
5590 GOTO 1
5600 GOTO 1
5610 GOTO 1
5620 GOTO 1
5630 GOTO 1
5640 GOTO 1
5650 GOTO 1
5660 GOTO 1
5670 GOTO 1
5680 GOTO 1
5690 GOTO 1
5700 GOTO 1
5710 GOTO 1
5720 GOTO 1
5730 GOTO 1
5740 GOTO 1
5750 GOTO 1
5760 GOTO 1
5770 GOTO 1
5780 GOTO 1
5790 GOTO 1
5800 GOTO 1
5810 GOTO 1
5820 GOTO 1
5830 GOTO 1
5840 GOTO 1
5850 GOTO 1
5860 GOTO 1
5870 GOTO 1
5880 GOTO 1
5890 GOTO 1
5900 GOTO 1
5910 GOTO 1
5920 GOTO 1
5930 GOTO 1
5940 GOTO 1
5950 GOTO 1
5960 GOTO 1
5970 GOTO 1
5980 GOTO 1
5990 GOTO 1
6000 GOTO 1
6010 GOTO 1
6020 GOTO 1
6030 GOTO 1
6040 GOTO 1
6050 GOTO 1
6060 GOTO 1
6070 GOTO 1
6080 GOTO 1
6090 GOTO 1
6100 GOTO 1
6110 GOTO 1
6120 GOTO 1
6130 GOTO 1
6140 GOTO 1
6150 GOTO 1
6160 GOTO 1
6170 GOTO 1
6180 GOTO 1
6190 GOTO 1
6200 GOTO 1
6210 GOTO 1
6220 GOTO 1
6230 GOTO 1
6240 GOTO 1
6250 GOTO 1
6260 GOTO 1
6270 GOTO 1
6280 GOTO 1
6290 GOTO 1
6300 GOTO 1
6310 GOTO 1
6320 GOTO 1
6330 GOTO 1
6340 GOTO 1
6350 GOTO 1
6360 GOTO 1
6370 GOTO 1
6380 GOTO 1
6390 GOTO 1
6400 GOTO 1
6410 GOTO 1
6420 GOTO 1
6430 GOTO 1
6440 GOTO 1
6450 GOTO 1
6460 GOTO 1
6470 GOTO 1
6480 GOTO 1
6490 GOTO 1
6500 GOTO 1
6510 GOTO 1
6520 GOTO 1
6530 GOTO 1
6540 GOTO 1
6550 GOTO 1
6560 GOTO 1
6570 GOTO 1
6580 GOTO 1
6590 GOTO 1
6600 GOTO 1
6610 GOTO 1
6620 GOTO 1
6630 GOTO 1
6640 GOTO 1
6650 GOTO 1
6660 GOTO 1
6670 GOTO 1
6680 GOTO 1
6690 GOTO 1
6700 GOTO 1
6710 GOTO 1
6720 GOTO 1
6730 GOTO 1
6740 GOTO 1
6750 GOTO 1
6760 GOTO 1
6770 GOTO 1
6780 GOTO 1
6790 GOTO 1
6800 GOTO 1
6810 GOTO 1
6820 GOTO 1
6830 GOTO 1
6840 GOTO 1
6850 GOTO 1
6860 GOTO 1
6870 GOTO 1
6880 GOTO 1
6890 GOTO 1
6900 GOTO 1
6910 GOTO 1
6920 GOTO 1
6930 GOTO 1
6940 GOTO 1
6950 GOTO 1
6960 GOTO 1
6970 GOTO 1
6980 GOTO 1
6990 GOTO 1
7000 GOTO 1
7010 GOTO 1
7020 GOTO 1
7030 GOTO 1
7040 GOTO 1
7050 GOTO 1
7060 GOTO 1
7070 GOTO 1
7080 GOTO 1
7090 GOTO 1
7100 GOTO 1
7110 GOTO 1
7120 GOTO 1
7130 GOTO 1
7140 GOTO 1
7150 GOTO 1
7160 GOTO 1
7170 GOTO 1
7180 GOTO 1
7190 GOTO 1
7200 GOTO 1
7210 GOTO 1
7220 GOTO 1
7230 GOTO 1
7240 GOTO 1
7250 GOTO 1
7260 GOTO 1
7270 GOTO 1
7280 GOTO 1
7290 GOTO 1
7300 GOTO 1
7310 GOTO 1
7320 GOTO 1
7330 GOTO 1
7340 GOTO 1
7350 GOTO 1
7360 GOTO 1
7370 GOTO 1
7380 GOTO 1
7390 GOTO 1
7400 GOTO 1
7410 GOTO 1
7420 GOTO 1
7430 GOTO 1
7440 GOTO 1
7450 GOTO 1
7460 GOTO 1
7470 GOTO 1
7480 GOTO 1
7490 GOTO 1
7500 GOTO 1
7510 GOTO 1
7520 GOTO 1
7530 GOTO 1
7540 GOTO 1
7550 GOTO 1
7560 GOTO 1
7570 GOTO 1
7580 GOTO 1
7590 GOTO 1
7600 GOTO 1
7610 GOTO 1
7620 GOTO 1
7630 GOTO 1
7640 GOTO 1
7650 GOTO 1
7660 GOTO 1
7670 GOTO 1
7680 GOTO 1
7690 GOTO 1
7700 GOTO 1
7710 GOTO 1
7720 GOTO 1
7730 GOTO 1
7740 GOTO 1
7750 GOTO 1
7760 GOTO 1
7770 GOTO 1
7780 GOTO 1
7790 GOTO 1
7800 GOTO 1
7810 GOTO 1
7820 GOTO 1
7830 GOTO 1
7840 GOTO 1
7850 GOTO 1
7860 GOTO 1
7870 GOTO 1
7880 GOTO 1
7890 GOTO 1
7900 GOTO 1
7910 GOTO 1
7920 GOTO 1
7930 GOTO 1
7940 GOTO 1
7950 GOTO 1
7960 GOTO 1
7970 GOTO 1
7980 GOTO 1
7990 GOTO 1
8000 GOTO 1
8010 GOTO 1
8020 GOTO 1
8030 GOTO 1
8040 GOTO 1
8050 GOTO 1
8060 GOTO 1
8070 GOTO 1
8080 GOTO 1
8090 GOTO 1
8100 GOTO 1
8110 GOTO 1
8120 GOTO 1
8130 GOTO 1
8140 GOTO 1
8150 GOTO 1
8160 GOTO 1
8170 GOTO 1
8180 GOTO 1
8190 GOTO 1
8200 GOTO 1
8210 GOTO 1
8220 GOTO 1
8230 GOTO 1
8240 GOTO 1
8250 GOTO 1
8260 GOTO 1
8270 GOTO 1
8280 GOTO 1
8290 GOTO 1
8300 GOTO 1
8310 GOTO 1
8320 GOTO 1
8330 GOTO 1
8340 GOTO 1
8350 GOTO 1
8360 GOTO 1
8370 GOTO 1
8380 GOTO 1
8390 GOTO 1
8400 GOTO 1
8410 GOTO 1
8420 GOTO 1
8430 GOTO 1
8440 GOTO 1
8450 GOTO 1
8460 GOTO 1
8470 GOTO 1
8480 GOTO 1
8490 GOTO 1
8500 GOTO 1
8510 GOTO 1
8520 GOTO 1
8530 GOTO 1
8540 GOTO 1
8550 GOTO 1
8560 GOTO 1
8570 GOTO 1
8580 GOTO 1
8590 GOTO 1
8600 GOTO 1
8610 GOTO 1
8620 GOTO 1
8630 GOTO 1
8640 GOTO 1
8650 GOTO 1
8660 GOTO 1
8670 GOTO 1
8680 GOTO 1
8690 GOTO 1
8700 GOTO 1
8710 GOTO 1
8720 GOTO 1
8730 GOTO 1
8740 GOTO 1
8750 GOTO 1
8760 GOTO 1
8770 GOTO 1
8780 GOTO 1
8790 GOTO 1
8800 GOTO 1
8810 GOTO 1
8820 GOTO 1
8830 GOTO 1
8840 GOTO 1
8850 GOTO 1
8860 GOTO 1
8870 GOTO 1
8880 GOTO 1
8890 GOTO 1
8900 GOTO 1
8910 GOTO 1
8920 GOTO 1
8930 GOTO 1
8940 GOTO 1
8950 GOTO 1
8960 GOTO 1
8970 GOTO 1
8980 GOTO 1
8990 GOTO 1
9000 GOTO 1
9010 GOTO 1
9020 GOTO 1
9030 GOTO 1
9040 GOTO 1
9050 GOTO 1
9060 GOTO 1
9070 GOTO 1
9080 GOTO 1
9090 GOTO 1
9100 GOTO 1
9110 GOTO 1
9120 GOTO 1
9130 GOTO 1
9140 GOTO 1
9150 GOTO 1
9160 GOTO 1
9170 GOTO 1
9180 GOTO 1
9190 GOTO 1
9200 GOTO 1
9210 GOTO 1
9220 GOTO 1
9230 GOTO 1
9240 GOTO 1
9250 GOTO 1
9260 GOTO 1
9270 GOTO 1
9280 GOTO 1
9290 GOTO 1
9300 GOTO 1
9310 GOTO 1
9320 GOTO 1
9330 GOTO 1
9340 GOTO 1
9350 GOTO 1
9360 GOTO 1
9370 GOTO 1
9380 GOTO 1
9390 GOTO 1
9400 GOTO 1
9410 GOTO 1
9420 GOTO 1
9430 GOTO 1
9440 GOTO 1
9450 GOTO 1
9460 GOTO 1
9470 GOTO 1
9480 GOTO 1
9490 GOTO 1
9500 GOTO 1
9510 GOTO 1
9520 GOTO 1
9530 GOTO 1
9540 GOTO 1
9550 GOTO 1
9560 GOTO 1
9570 GOTO 1
9580 GOTO 1
9590 GOTO 1
9600 GOTO 1
9610 GOTO 1
9620 GOTO 1
9630 GOTO 1
9640 GOTO 1
9650 GOTO 1
9660 GOTO 1
9670 GOTO 1
9680 GOTO 1
9690 GOTO 1
9700 GOTO 1
9710 GOTO 1
9720 GOTO 1
9730 GOTO 1
9740 GOTO 1
9750 GOTO 1
9760 GOTO 1
9770 GOTO 1
9780 GOTO 1
9790 GOTO 1
9800 GOTO 1
9810 GOTO 1
9820 GOTO 1
9830 GOTO 1
9840 GOTO 1
9850 GOTO 1
9860 GOTO 1
9870 GOTO 1
9880 GOTO 1
9890 GOTO 1
9900 GOTO 1
9910 GOTO 1
9920 GOTO 1
9930 GOTO 1
9940 GOTO 1
9950 GOTO 1
9960 GOTO 1
9970 GOTO 1
9980 GOTO 1
9990 GOTO 1
10000 GOTO 1

```

Big letters  
by Martin Howse


```

1 PRINT "BIG LETTERS"
2 PRINT "THIS PROGRAM WILL ASK YOU TO ENTER SOME WORDS AND IT WILL"
3 PRINT "SCROLL THE WORDS IN LARGE LETTERS UP THE SCREEN, YOU MAY HAVE"
4 PRINT "COLOUR LETTERS BY PRESSING CTRL AND THE COLOUR WANTED WHEN YOU"
5 PRINT "ENTER THE WORDS."
6 INPUT "PLEASE ENTER MESSAGE:"
7 FOR I=1 TO 255
8   READ (A-B)
9   THEN A=B:PRINT " "
10  FOR J=1 TO 255
11   READ (C-D)
12   THEN C=D:PRINT " "
13  FOR K=1 TO 255
14   READ (E-F)
15   THEN E=F:PRINT " "
16  FOR L=1 TO 255
17   READ (G-H)
18   THEN G=H:PRINT " "
19  FOR M=1 TO 255
20   READ (I-J)
21   THEN I=J:PRINT " "
22  FOR N=1 TO 255
23   READ (K-L)
24   THEN K=L:PRINT " "
25  FOR O=1 TO 255
26   READ (M-N)
27   THEN M=N:PRINT " "
28  FOR P=1 TO 255
29   READ (O-P)
30   THEN O=P:PRINT " "
31  FOR Q=1 TO 255
32   READ (P-Q)
33   THEN P=Q:PRINT " "
34  FOR R=1 TO 255
35   READ (Q-R)
36   THEN Q=R:PRINT " "
37  FOR S=1 TO 255
38   READ (R-S)
39   THEN R=S:PRINT " "
40  FOR T=1 TO 255
41   READ (S-T)
42   THEN S=T:PRINT " "
43  FOR U=1 TO 255
44   READ (T-U)
45   THEN T=U:PRINT " "
46  FOR V=1 TO 255
47   READ (U-V)
48   THEN U=V:PRINT " "
49  FOR W=1 TO 255
50   READ (V-W)
51   THEN V=W:PRINT " "
52  FOR X=1 TO 255
53   READ (W-X)
54   THEN W=X:PRINT " "
55  FOR Y=1 TO 255
56   READ (X-Y)
57   THEN X=Y:PRINT " "
58  FOR Z=1 TO 255
59   READ (Y-Z)
60   THEN Y=Z:PRINT " "
61  FOR AA=1 TO 255
62   READ (Z-AA)
63   THEN Z=AA:PRINT " "
64  FOR AB=1 TO 255
65   READ (AA-AB)
66   THEN AB=AA:PRINT " "
67  FOR AC=1 TO 255
68   READ (AB-AC)
69   THEN AC=AB:PRINT " "
70  FOR AD=1 TO 255
71   READ (AC-AD)
72   THEN AD=AC:PRINT " "
73  FOR AE=1 TO 255
74   READ (AD-AE)
75   THEN AE=AD:PRINT " "
76  FOR AF=1 TO 255
77   READ (AE-AF)
78   THEN AF=AE:PRINT " "
79  FOR AG=1 TO 255
80   READ (AF-AG)
81   THEN AG=AF:PRINT " "
82  FOR AH=1 TO 255
83   READ (AG-AH)
84   THEN AH=AG:PRINT " "
85  FOR AI=1 TO 255
86   READ (AH-AI)
87   THEN AI=AH:PRINT " "
88  FOR AJ=1 TO 255
89   READ (AI-AJ)
90   THEN AJ=AI:PRINT " "
91  FOR AK=1 TO 255
92   READ (AJ-AK)
93   THEN AK=AJ:PRINT " "
94  FOR AL=1 TO 255
95   READ (AK-AL)
96   THEN AL=AK:PRINT " "
97  FOR AM=1 TO 255
98   READ (AL-AM)
99   THEN AM=AL:PRINT " "
100 FOR AN=1 TO 255
101  READ (AM-AN)
102  THEN AN=AM:PRINT " "
103 FOR AO=1 TO 255
104  READ (AN-AO)
105  THEN AO=AN:PRINT " "
106 FOR AP=1 TO 255
107  READ (AO-AP)
108  THEN AP=AO:PRINT " "
109 FOR AQ=1 TO 255
110  READ (AP-AQ)
111  THEN AQ=AP:PRINT " "
112 FOR AR=1 TO 255
113  READ (AQ-AR)
114  THEN AR=AQ:PRINT " "
115 FOR AS=1 TO 255
116  READ (AR-AS)
117  THEN AS=AR:PRINT " "
118 FOR AT=1 TO 255
119  READ (AS-AT)
120  THEN AT=AS:PRINT " "
121 FOR AU=1 TO 255
122  READ (AT-AU)
123  THEN AU=AT:PRINT " "
124 FOR AV=1 TO 255
125  READ (AU-AV)
126  THEN AV=AU:PRINT " "
127 FOR AW=1 TO 255
128  READ (AV-AW)
129  THEN AW=AV:PRINT " "
130 FOR AX=1 TO 255
131  READ (AW-AX)
132  THEN AX=AW:PRINT " "
133 FOR AY=1 TO 255
134  READ (AX-AY)
135  THEN AY=AX:PRINT " "
136 FOR AZ=1 TO 255
137  READ (AY-AZ)
138  THEN AZ=AY:PRINT " "
139 FOR BA=1 TO 255
140  READ (AZ-BA)
141  THEN BA=AZ:PRINT " "
142 FOR BB=1 TO 255
143  READ (BA-BB)
144  THEN BB=BA:PRINT " "
145 FOR BC=1 TO 255
146  READ (BB-BC)
147  THEN BC=BB:PRINT " "
148 FOR BD=1 TO 255
149  READ (BC-BD)
150  THEN BD=BC:PRINT " "
151 FOR BE=1 TO 255
152  READ (BD-BE)
153  THEN BE=BD:PRINT " "
154 FOR BF=1 TO 255
155  READ (BE-BF)
156  THEN BF=BE:PRINT " "
157 FOR BG=1 TO 255
158  READ (BF-BG)
159  THEN BG=BF:PRINT " "
160 FOR BH=1 TO 255
161  READ (BG-BH)
162  THEN BH=BG:PRINT " "
163 FOR BI=1 TO 255
164  READ (BH-BI)
165  THEN BI=BH:PRINT " "
166 FOR BJ=1 TO 255
167  READ (BI-BJ)
168  THEN BJ=BI:PRINT " "
169 FOR BK=1 TO 255
170  READ (BJ-BK)
171  THEN BK=BJ:PRINT " "
172 FOR BL=1 TO 255
173  READ (BK-BL)
174  THEN BL=BK:PRINT " "
175 FOR BM=1 TO 255
176  READ (BL-BM)
177  THEN BM=BL:PRINT " "
178 FOR BN=1 TO 255
179  READ (BM-BN)
180  THEN BN=BM:PRINT " "
181 FOR BO=1 TO 255
182  READ (BN-BO)
183  THEN BO=BN:PRINT " "
184 FOR BP=1 TO 255
185  READ (BO-BP)
186  THEN BP=BO:PRINT " "
187 FOR BQ=1 TO 255
188  READ (BP-BQ)
189  THEN BQ=BP:PRINT " "
190 FOR BR=1 TO 255
191  READ (BQ-BR)
192  THEN BR=BQ:PRINT " "
193 FOR BS=1 TO 255
194  READ (BR-BS)
195  THEN BS=BR:PRINT " "
196 FOR BT=1 TO 255
197  READ (BS-BT)
198  THEN BT=BS:PRINT " "
199 FOR BU=1 TO 255
200  READ (BT-BU)
201  THEN BU=BT:PRINT " "
202 FOR BV=1 TO 255
203  READ (BU-BV)
204  THEN BV=BU:PRINT " "
205 FOR BW=1 TO 255
206  READ (BV-BW)
207  THEN BW=BV:PRINT " "
208 FOR BX=1 TO 255
209  READ (BW-BX)
210  THEN BX=BW:PRINT " "
211 FOR BY=1 TO 255
212  READ (BX-BY)
213  THEN BY=BX:PRINT " "
214 FOR BZ=1 TO 255
215  READ (BY-BZ)
216  THEN BZ=BY:PRINT " "
217 FOR CA=1 TO 255
218  READ (BZ-CA)
219  THEN CA=BZ:PRINT " "
220 FOR CB=1 TO 255
221  READ (CA-CB)
222  THEN CB=CA:PRINT " "
223 FOR CC=1 TO 255
224  READ (CB-CC)
225  THEN CC=CB:PRINT " "
226 FOR CD=1 TO 255
227  READ (CC-CD)
228  THEN CD=CC:PRINT " "
229 FOR CE=1 TO 255
230  READ (CD-CE)
231  THEN CE=CD:PRINT " "
232 FOR CF=1 TO 255
233  READ (CE-CF)
234  THEN CF=CE:PRINT " "
235 FOR CG=1 TO 255
236  READ (CF-CG)
237  THEN CG=CF:PRINT " "
238 FOR CH=1 TO 255
239  READ (CG-CH)
240  THEN CH=CG:PRINT " "
241 FOR CI=1 TO 255
242  READ (CH-CI)
243  THEN CI=CH:PRINT " "
244 FOR CJ=1 TO 255
245  READ (CI-CJ)
246  THEN CJ=CI:PRINT " "
247 FOR CK=1 TO 255
248  READ (CJ-CK)
249  THEN CK=CJ:PRINT " "
250 FOR CL=1 TO 255
251  READ (CK-CL)
252
```

# New ZX81 Software from Sinclair.

A whole new range of software for the Sinclair ZX81 Personal Computer is now available - direct from Sinclair. Produced by ICL and Palon, these really excellent cassettes cover games, education, and business/household management.

Some of the more elaborate programs can only be run on a ZX81 augmented by the ZX 16K RAM pack (The description of each cassette makes it clear what hardware is required.) The RAM pack provides 16 times more memory in one complete module, and simply plugs into the rear of a ZX81. And the price has just been dramatically reduced to only £29.95.

The Sinclair  Printer offers full alphanumerics and highly sophisticated graphics. A special feature is COPY which prints out exactly what is on the whole TV screen without the need for further instructions. So now you can print out your results for a permanent record. The ZX Printer plugs into the rear of your ZX81, and you can connect a RAM pack as well.

## Games

### Cassette G1: Super Programs 1 (ICL)

Hardware required - ZX81

Price - £4.95

Programs - Invasion from Jupiter, Skiffles, Magic Square, Doodle Kim, Liquid Capacity.  
Description - Five games programs plus easy conversion between pints/gallons and litres.

### Cassette G2: Super Programs 2 (ICL)

Hardware required - ZX81


Price - £4.95

Programs - Rings around Saturn, Secret Code, Mindboggling, Silhouette, Memory Test, Metric conversion.  
Description - Five games plus easy conversion between inches/feet/yards and centimetres/metres.

### Cassette G3: Super Programs 3 (ICL)

Hardware required - ZX81

Price - £4.95

Programs - Brain Race, Challenge, Secret Message, Mind that Molecrat, Character Dodge, Currency Conversion.  
Description - Five games plus currency conversion at will - for example dollars  pounds.

### Cassette G4: Super Programs 4 (ICL)

Hardware required - ZX81

Price - £4.95

Programs - Down Under, Submarines, Doodling with Graphics, The Invisible Invader, Reaction Patrol.  
Description - Five games plus easy conversion between miles per gallon and European fuel consumption figures.

### Cassette G5: Super Programs 5 (ICL)

Hardware required - ZX81 + 16K RAM

Price - £4.95

Programs - Martian Knock Out, Graffiti, Find the Male, Labyrinth, Drop a Brick, Continental.  
Description - Five games plus easy conversion between English and continental dress sizes.

### Cassette G6: Super Programs 6 (ICL)

Hardware required - ZX81 + 16K RAM

Price - £4.95

Programs - Galactic Invasion, Journey into Danger, Create, Nine Hole Golf, Solitaire, Daylight Robbery.  
Description - Six games making full use of the ZX81's moving graphics capability.

### Cassette G7: Super Programs 7 (ICL)

Hardware required - ZX81

Price - £4.95

Programs - Racetrack, Chase NIM, Tower of Hanoi, Docking the Spaceship, Golf.


Description - Six games including the fascinating Tower  Hanoi problem.

### Cassette G8: Super Programs 8 (ICL)

Hardware required - ZX81 + 16K RAM

Price - £4.95

Programs - Star Trail (plus blank tape on side B).


Description - Can you, as Captain Church of the UK spaceship Endeavour, rid the galaxy  of the Klingon menace?

### Cassette G9: Biorythms (ICL)

Hardware required - ZX81 + 16K RAM

Price - £6.95

Programs - What are Biorythms? Your Biorythms.

Description - When will you be  your peak (and trough) physically, emotionally, and intellectually?

### Cassette G10: Backgammon (Palon)

Hardware required - ZX81 + 16K RAM



Price - £5.95

Programs - Backgammon Dice.  
Description - A great program using fast and efficient machine code, with graphics board, rolling dice, and doubling dice. The dice program can be used for any dice game.

### Cassette G11: Chess (Palon)

Hardware required - ZX81 + 16K RAM

Price - £6.95

Programs - Chess, Chess Clock.  
Description - Fast, efficient machine code, a graphics display  the board and pieces, plus six levels of ability combine to make this one of the best chess programs available. The Chess Clock program can be used  any time.




### Cassette G12

#### Fantasy Games (Palon)

Hardware required - ZX81 (or ZX80 with 8K BASIC ROM) + 16K RAM

Price - £4.75

Programs - Porteous Swamp, Sorcerer's Island.

Description - Porteous Swamp, rescue a beautiful princess from the evil wizard Sorcerer's Island; you're marooned, to escape, you'll probably need the help  of the Grand Sorcerer.

### Cassette G13:

#### Space Raiders and Bomber (Palon)

Hardware required - ZX81 + 16K RAM

Price - £3.95

Programs - Space Raiders, Bomber.  
Description - Space Raiders is the ZX81 version of the popular pub game, Bomber, destroy a city before you hit a sky scraper.

### Cassette G14: Flight Simulation (Palon)

Hardware required - ZX81 + 16K RAM

Price - £5.95

Program - Flight Simulation (plus blank tape on side 2).

Description - Simulate a highly manoeuvrable light aircraft with full controls, instrumentation, a view through the cockpit window, and navigational aids. Happy landings!

## Education

### Cassette E1: Fun to Learn series -

#### English Literature 1 (ICL)

Hardware required - ZX81 + 16K RAM.

Price - £6.95

Programs - Novelists, Authors.

Description - Who wrote Robinson Crusoe? Which novelist do you associate with Father Brown?

### Cassette E2: Fun to Learn series -

#### English Literature 2 (ICL)

Hardware required - ZX81 + 16K RAM

Price - £6.95

Programs - Poets, Playwrights, Modern Authors.

Description - Who wrote 'Song of the Shirt'? Which playwright also played cricket for England?



## Open Forum

pair of hex codes, in turn,

```

10 REM ***
20 INPUT AS
30 IF LEN(AS) < 1 THEN GOTO 20
40 SCROLL
50 FOR I = 1 TO CODES - AS : CODE AS2 = I * 4
60 PRINT " " AS
70 GOTO 10

```

To see how the routine is used, delete lines 50 to 70 and add the following

```

21 LET S = 1000
22 PRINT TAB(5); 2. THIS IS AN EXAMPLE
  TAB(5); 2. OF THE USE OF THIS
  SURROUNDING TAB(5); TAB(5);
23 FOR I = 1 TO 10
24 NEXT I
25 GOTO 12

```

## Star Trek

on the Moon.

It is a little-known fact that the scripts of *Star Trek* were produced by Paramount's previous 16mm video operations center. Now I have replicated the script in Video BBC Micro. Instead, it has proved possible to improve upon the original producing scripts of a higher calibre than those filmed.

Of course, the program produces scripts of variable length. Paramount handled this by inserting 14-15s and some profanity to pad out the episodes.

The program will run on either the Model A or B. Make sure that the strings in lines 130 and 505 are identical or the program will never end (that's how they got the movie picture).

Note that the only DATA strings requiring quotes are those containing commas. Also note the spaces which prevent words being split by line feeds.

### Partial screen clear

by Carolyn Steffen

After writing a program to help with tax returns, I found I needed a program to clear parts of the ZX81's display while leaving the lines showing the totals of each column intact.

The following machine code routine does the very same thing and needed only minor changes to make it function as a very fast equivalent to the C library routine. This was considered necessary as the C library command takes some time when the display and memory are full. It also leaves characters immediately drawn at the edge of the screen when it is called.

Further, you can use the fast REM statement and call the routines by USB16514, which I find makes the LOADING of some programs, like the kernel, to make use of the 5xTt's system variable. This is the BASIC loader program for the panel screen clear routine.

[illegible]

The program can then be RUN and the decimal codes entered one at a time, followed by "END". The program codes 26 bytes, and now works as explained in the next two columns: the decimal codes being in prearranged columns, each separated by a comma.

40. (A) 1.2  $\times 10^4$  m/s. The proton is accelerated with the same voltage as the electron, so it has the same kinetic energy. Since the proton is much heavier than the electron, it has a much smaller velocity.

**PROGRAM OF THE WEEK**

[illegible]

```

This routine can now be called by GOSUB
9900. Its effect will depend on the last PRINT
statement executed. If it is like
100 PRINT AT 12.5,200
110 GOTO 9900
then the screen will be cleared from line
10 column 10 to the bottom corner of the
screen. If the statement is
100 PRINT AT 12.5,200
110 GOTO 9900

```

then the screen will be cleared from line 15, column 0 to the bottom of the screen. The effect of this will only be seen if the screen was already full of course. Using this property of the last screen can the desired type of display clearing can be obtained.

The second program was written to overcome the slowness of the GUS function. It is 24 bytes long and can be entered using a similar program to the one used previously.

```
0000FF00A:1C n  
9000L21 A+=15:K:10425+256PEEK10426-5)  
9010PROM123456789012345678901234  
9020J=J-M: A TO A+23  
9030B=J:GOTO
```

[Go next page](#)

[illegible]

Star Trek  
by Ian Bell



# Open Forum

from previous page

2040 POK% N%  
2050 PRINT V

The code to be entered is similar to that of the other routine but always assumes that the PRINT position is at line 0, hence the need for line 2000 to ensure that it is. The decimal codes for this program are as follows:

41 14 54 4 22 1 26 254 1 18 32 8 5 128 254 0

32 4 21 5 54 8 25 24 0 8 20 1

Does line 2000 2000 2040 2050

Change 2000 to LET RM=USRPGCL\$4254 ... etc.

ADD 30 15 RETURN

This routine can now be called by GOSUB 2000 whenever a CLS command would previously be used in the main program. The screen clearing operation is far quicker than CLS if the display and memory are completely full.

If the program is very long then it may be advantageous to put this subroutine at the beginning of the main program by altering the line numbers and using a GOTO statement to jump over it to start the main program. This will stop BASIC wasting time searching through many line numbers until it finds the one referred to by the GOSUB. This is a point to bear in mind when writing any long program with many GOSUBs that refer to line numbers at the end of the main program. To put these subroutines at the beginning will help speed up program running time.

## Maze

on Vis-80

This program runs on a standard Vic and is a maze game where you compete against the clock. Movement is through the four function keys and full instructions are included in the program. Take care when keying in the program as put spaces in lines as it adds to the layout of the screen.

## Hex-decimal converter

on Vis-80

This program is quite straightforward. The control is passed to one of two routines dependent upon the last character entered.

If the last character is 'h' the hex to decimal routine is called, otherwise the input is checked for a numeric value (line 150). The error message is displayed if the input does not meet these criteria, and the program returns to the start. The error message is also called if spaces are embedded in the string during the hex to decimal routine.

When using the STR\$ function a space is added to the front of the result (line 250).

to next page

Maze

by T. Watton

# Open Forum

from previous page

takes this space out so that the output looks neater. Lines 360 and 240 take care of the box values A to F by converting them to decimal 10 to 15 and vice versa.

## Sketch pad

on ZX81

This sketch pad program enables you to draw your own pictures and diagrams. To start simply type in line 10 as:

```
10 REM ***** SKETCH *****
```

Then type

```
23 FOR A=10514 TO 10550
```

```
30 INPUT A
```

```
40 IF A=0 THEN
```

```
50 NEXT A
```

and then RUN

Follow on by inputting these numbers in turn

```
42, 12, 64, 35, 22, 1, 30, 1, 128, 6, 128,
203, 79, 40, 3, 144, 24, 1, 128, 116, 35, 20,
62, 33, 186, 32, 237, 35, 22, 1, 29, 67, 23,
187, 200, 24, 227
```

After doing that delete lines 20 to 50 by typing in the rest of the program. SAVE all your work on to magnetic before running. When RUN all will be made clear.

The inverse-video function enables you to edit your picture by changing to inverse and then blank in the whole where the mistake was, then change back to normal video.

Maybe the National Gallery will accept some ZX masterpieces or have a special modern art display

## Hex-decimal converter

by Ken Clark

```
100 REM VIC-DECHEXDEC 1.54 VIC 1281 CLASS 1382
110 REM
120 REM CHANGES DECIMAL TO HEXDECIMAL VIA VIC VERSION
130 REM POLARISE INPUT WITH THE LETTER H
140 REM WITH NO INTERVENING SPACES OR FFH
150 REM INPUT DECIMAL WITH NO EXTRA CHARACTER
160 REM
170 INPUTS
180 IF RIGHT$(A$,1)="" THEN LEN$(A$)=LEN$(A$)+1:GOTO220
190 IF ASC(LEFT$(A$,1))=57 THEN A$=LEFT$(A$,1)+10
200 REM## DEC TO HEX ##
210 A=VAL(A$)
220 B=INT(A/16)
230 P=A-16*B
240 IF P THEN P=CHR$(P+55):GOTO250
250 P=RIGHT$(STR$(P),1)
260 A=B
270 IF A=0 THEN GOTO290
280 GOTO220
290 PRINTA$;" DECIMAL=";"&P;" HEX"
300 GOTO430
310 REM## HEX TO DEC ##
320 B=LEFT$(A$,1)
330 FOR I=0 TO L-1
340 I=I+1:GOTO350
350 IF ASC(I) < 57 THEN I=I+10:GOTO360
360 I=ASC(I)-55
370 A=VAL(STR$(I))
380 A=A*16+I
390 L=L-1:GOTO350
400 PRINTB$;" HEX=";"&A;" DECIMAL"
410 GOTO430
420 PRINT"INPUT ERROR TRY AGAIN"
430 END:GOTO1
```

Sketch pad  
by A Jones

```
10 REM ***** SKETCH *****
20 REM ***** SKETCH *****
30 REM ***** SKETCH *****
40 REM ***** SKETCH *****
50 REM ***** SKETCH *****
60 REM ***** SKETCH *****
70 REM ***** SKETCH *****
80 REM ***** SKETCH *****
90 REM ***** SKETCH *****
100 REM ***** SKETCH *****
110 REM ***** SKETCH *****
120 REM ***** SKETCH *****
130 REM ***** SKETCH *****
140 REM ***** SKETCH *****
150 REM ***** SKETCH *****
160 REM ***** SKETCH *****
170 REM ***** SKETCH *****
180 REM ***** SKETCH *****
190 REM ***** SKETCH *****
200 REM ***** SKETCH *****
210 REM ***** SKETCH *****
220 REM ***** SKETCH *****
230 REM ***** SKETCH *****
240 REM ***** SKETCH *****
250 REM ***** SKETCH *****
260 REM ***** SKETCH *****
270 REM ***** SKETCH *****
280 REM ***** SKETCH *****
290 REM ***** SKETCH *****
300 REM ***** SKETCH *****
310 REM ***** SKETCH *****
320 REM ***** SKETCH *****
330 REM ***** SKETCH *****
340 REM ***** SKETCH *****
350 REM ***** SKETCH *****
360 REM ***** SKETCH *****
370 REM ***** SKETCH *****
380 REM ***** SKETCH *****
390 REM ***** SKETCH *****
400 REM ***** SKETCH *****
410 REM ***** SKETCH *****
420 REM ***** SKETCH *****
430 REM ***** SKETCH *****
440 REM ***** SKETCH *****
450 REM ***** SKETCH *****
460 REM ***** SKETCH *****
470 REM ***** SKETCH *****
480 REM ***** SKETCH *****
490 REM ***** SKETCH *****
500 REM ***** SKETCH *****
510 REM ***** SKETCH *****
520 REM ***** SKETCH *****
530 REM ***** SKETCH *****
540 REM ***** SKETCH *****
550 REM ***** SKETCH *****
560 REM ***** SKETCH *****
570 REM ***** SKETCH *****
580 REM ***** SKETCH *****
590 REM ***** SKETCH *****
600 REM ***** SKETCH *****
610 REM ***** SKETCH *****
620 REM ***** SKETCH *****
630 REM ***** SKETCH *****
640 REM ***** SKETCH *****
650 REM ***** SKETCH *****
660 REM ***** SKETCH *****
670 REM ***** SKETCH *****
680 REM ***** SKETCH *****
690 REM ***** SKETCH *****
700 REM ***** SKETCH *****
710 REM ***** SKETCH *****
720 REM ***** SKETCH *****
730 REM ***** SKETCH *****
740 REM ***** SKETCH *****
750 REM ***** SKETCH *****
760 REM ***** SKETCH *****
770 REM ***** SKETCH *****
780 REM ***** SKETCH *****
790 REM ***** SKETCH *****
800 REM ***** SKETCH *****
810 REM ***** SKETCH *****
820 REM ***** SKETCH *****
830 REM ***** SKETCH *****
840 REM ***** SKETCH *****
850 REM ***** SKETCH *****
860 REM ***** SKETCH *****
870 REM ***** SKETCH *****
880 REM ***** SKETCH *****
890 REM ***** SKETCH *****
900 REM ***** SKETCH *****
910 REM ***** SKETCH *****
920 REM ***** SKETCH *****
930 REM ***** SKETCH *****
940 REM ***** SKETCH *****
950 REM ***** SKETCH *****
960 REM ***** SKETCH *****
970 REM ***** SKETCH *****
980 REM ***** SKETCH *****
990 REM ***** SKETCH *****
1000 REM ***** SKETCH *****
```

```
1000 IF A=0 THEN GOTO 5000
1010 IF A=1 THEN GOTO 5000
1020 IF A=2 THEN GOTO 5000
1030 IF A=3 THEN GOTO 5000
1040 GOTO 5000
1050 REM ***** SKETCH *****
1060 LET C=CODE A$-55
1070 LET X=X+1:IF C=57 THEN X=X+10
1080 LET Y=Y+1:IF C=57 THEN Y=Y+10
1090 GOTO 5000
1100 REM ***** SKETCH *****
1110 PRINT AT 21,0;"POINT1, HOW MANY SPACES UP?"
1120 INPUT A
1130 IF A=0 AND A<64 THEN GOTO 5000
1140 GOTO 5000
1150 REM ***** SKETCH *****
1160 PRINT AT 21,0;"POINT2, HOW MANY SPACES ALONG?"
1170 INPUT B
1180 IF B=0 AND B<64 THEN GOTO 5000
1190 GOTO 5000
1200 REM ***** SKETCH *****
1210 PRINT AT 21,0;"POINT3, HOW MANY SPACES ALONG?"
1220 INPUT C
1230 IF C=0 AND C<64 THEN GOTO 5000
1240 GOTO 5000
1250 REM ***** SKETCH *****
1260 PRINT AT 21,0;"POINT4, HOW MANY SPACES UP?"
```

## 110

## Open Forum

[illegible]

```

470 FOR I=1 TO 70
480 PAUSE
490 PRINT I
500 GOTO 520
510 PRINT " 21.1.1. ZOMBIE GOT A"
520 YOU LOSE
530 FOR I=1 TO 300
540 PRINT AT 22,10, "EM"
550 FOR I=1 TO 20
560 PRINT " 21.1.1. ZOMBIE GOT A"
570 GOTO 590
580 PRINT " 21.1.1. ZOMBIE GOT A"
590 AT 22,10, "EM"
600 FOR I=1 TO 20
610 PRINT " 21.1.1. ZOMBIE GOT A"
620 GOTO 640
630 PRINT " 21.1.1. ZOMBIE GOT A"
640 GOTO 660
650 PRINT " 21.1.1. ZOMBIE GOT A"
660 GOTO 680
670 PRINT " 21.1.1. ZOMBIE GOT A"
680 GOTO 700
690 PRINT " 21.1.1. ZOMBIE GOT A"
700 GOTO 720
710 PRINT " 21.1.1. ZOMBIE GOT A"
720 GOTO 740
730 PRINT " 21.1.1. ZOMBIE GOT A"
740 GOTO 760
750 PRINT " 21.1.1. ZOMBIE GOT A"
760 GOTO 780
770 PRINT " 21.1.1. ZOMBIE GOT A"
780 GOTO 800
790 PRINT " 21.1.1. ZOMBIE GOT A"
800 GOTO 820
810 PRINT " 21.1.1. ZOMBIE GOT A"
820 GOTO 840
830 PRINT " 21.1.1. ZOMBIE GOT A"
840 GOTO 860
850 PRINT " 21.1.1. ZOMBIE GOT A"
860 GOTO 880
870 PRINT " 21.1.1. ZOMBIE GOT A"
880 GOTO 900
890 PRINT " 21.1.1. ZOMBIE GOT A"
900 GOTO 920
910 PRINT " 21.1.1. ZOMBIE GOT A"
920 GOTO 940
930 PRINT " 21.1.1. ZOMBIE GOT A"
940 GOTO 960
950 PRINT " 21.1.1. ZOMBIE GOT A"
960 GOTO 980
970 PRINT " 21.1.1. ZOMBIE GOT A"
980 GOTO 1000
990 PRINT " 21.1.1. ZOMBIE GOT A"
1000 GOTO 1020
1010 PRINT " 21.1.1. ZOMBIE GOT A"
1020 GOTO 1040
1030 PRINT " 21.1.1. ZOMBIE GOT A"
1040 GOTO 1060
1050 PRINT " 21.1.1. ZOMBIE GOT A"
1060 GOTO 1080
1070 PRINT " 21.1.1. ZOMBIE GOT A"
1080 GOTO 1100
1090 PRINT " 21.1.1. ZOMBIE GOT A"
1100 GOTO 1120
1110 PRINT " 21.1.1. ZOMBIE GOT A"
1120 GOTO 1140
1130 PRINT " 21.1.1. ZOMBIE GOT A"
1140 GOTO 1160
1150 PRINT " 21.1.1. ZOMBIE GOT A"
1160 GOTO 1180
1170 PRINT " 21.1.1. ZOMBIE GOT A"
1180 GOTO 1200
1190 PRINT " 21.1.1. ZOMBIE GOT A"
1200 GOTO 1220
1210 PRINT " 21.1.1. ZOMBIE GOT A"
1220 GOTO 1240
1230 PRINT " 21.1.1. ZOMBIE GOT A"
1240 GOTO 1260
1250 PRINT " 21.1.1. ZOMBIE GOT A"
1260 GOTO 1280
1270 PRINT " 21.1.1. ZOMBIE GOT A"
1280 GOTO 1300
1290 PRINT " 21.1.1. ZOMBIE GOT A"
1300 GOTO 1320
1310 PRINT " 21.1.1. ZOMBIE GOT A"
1320 GOTO 1340
1330 PRINT " 21.1.1. ZOMBIE GOT A"
1340 GOTO 1360
1350 PRINT " 21.1.1. ZOMBIE GOT A"
1360 GOTO 1380
1370 PRINT " 21.1.1. ZOMBIE GOT A"
1380 GOTO 1400
1390 PRINT " 21.1.1. ZOMBIE GOT A"
1400 GOTO 1420
1410 PRINT " 21.1.1. ZOMBIE GOT A"
1420 GOTO 1440
1430 PRINT " 21.1.1. ZOMBIE GOT A"
1440 GOTO 1460
1450 PRINT " 21.1.1. ZOMBIE GOT A"
1460 GOTO 1480
1470 PRINT " 21.1.1. ZOMBIE GOT A"
1480 GOTO 1500
1490 PRINT " 21.1.1. ZOMBIE GOT A"
1500 GOTO 1520
1510 PRINT " 21.1.1. ZOMBIE GOT A"
1520 GOTO 1540
1530 PRINT " 21.1.1. ZOMBIE GOT A"
1540 GOTO 1560
1550 PRINT " 21.1.1. ZOMBIE GOT A"
1560 GOTO 1580
1570 PRINT " 21.1.1. ZOMBIE GOT A"
1580 GOTO 1600
1590 PRINT " 21.1.1. ZOMBIE GOT A"
1600 GOTO 1620
1610 PRINT " 21.1.1. ZOMBIE GOT A"
1620 GOTO 1640
1630 PRINT " 21.1.1. ZOMBIE GOT A"
1640 GOTO 1660
1650 PRINT " 21.1.1. ZOMBIE GOT A"
1660 GOTO 1680
1670 PRINT " 21.1.1. ZOMBIE GOT A"
1680 GOTO 1700
1690 PRINT " 21.1.1. ZOMBIE GOT A"
1700 GOTO 1720
1710 PRINT " 21.1.1. ZOMBIE GOT A"
1720 GOTO 1740
1730 PRINT " 21.1.1. ZOMBIE GOT A"
1740 GOTO 1760
1750 PRINT " 21.1.1. ZOMBIE GOT A"
1760 GOTO 1780
1770 PRINT " 21.1.1. ZOMBIE GOT A"
1780 GOTO 1800
1790 PRINT " 21.1.1. ZOMBIE GOT A"
1800 GOTO 1820
1810 PRINT " 21.1.1. ZOMBIE GOT A"
1820 GOTO 1840
1830 PRINT " 21.1.1. ZOMBIE GOT A"
1840 GOTO 1860
1850 PRINT " 21.1.1. ZOMBIE GOT A"
1860 GOTO 1880
1870 PRINT " 21.1.1. ZOMBIE GOT A"
1880 GOTO 1900
1890 PRINT " 21.1.1. ZOMBIE GOT A"
1900 GOTO 1920
1910 PRINT " 21.1.1. ZOMBIE GOT A"
1920 GOTO 1940
1930 PRINT " 21.1.1. ZOMBIE GOT A"
1940 GOTO 1960
1950 PRINT " 21.1.1. ZOMBIE GOT A"
1960 GOTO 1980
1970 PRINT " 21.1.1. ZOMBIE GOT A"
1980 GOTO 2000
1990 PRINT " 21.1.1. ZOMBIE GOT A"
2000 GOTO 2020
2010 PRINT " 21.1.1. ZOMBIE GOT A"
2020 GOTO 2040
2030 PRINT " 21.1.1. ZOMBIE GOT A"
2040 GOTO 2060
2050 PRINT " 21.1.1. ZOMBIE GOT A"
2060 GOTO 2080
2070 PRINT " 21.1.1. ZOMBIE GOT A"
2080 GOTO 2100
2090 PRINT " 21.1.1. ZOMBIE GOT A"
2100 GOTO 2120
2110 PRINT " 21.1.1. ZOMBIE GOT A"
2120 GOTO 2140
2130 PRINT " 21.1.1. ZOMBIE GOT A"
2140 GOTO 2160
2150 PRINT " 21.1.1. ZOMBIE GOT A"
2160 GOTO 2180
2170 PRINT " 21.1.1. ZOMBIE GOT A"
2180 GOTO 2200
2190 PRINT " 21.1.1. ZOMBIE GOT A"
2200 GOTO 2220
2210 PRINT " 21.1.1. ZOMBIE GOT A"
2220 GOTO 2240
2230 PRINT " 21.1.1. ZOMBIE GOT A"
2240 GOTO 2260
2250 PRINT " 21.1.1. ZOMBIE GOT A"
2260 GOTO 2280
2270 PRINT " 21.1.1. ZOMBIE GOT A"
2280 GOTO 2300
2290 PRINT " 21.1.1. ZOMBIE GOT A"
2300 GOTO 2320
2310 PRINT " 21.1.1. ZOMBIE GOT A"
2320 GOTO 2340
2330 PRINT " 21.1.1. ZOMBIE GOT A"
2340 GOTO 2360
2350 PRINT " 21.1.1. ZOMBIE GOT A"
2360 GOTO 2380
2370 PRINT " 21.1.1. ZOMBIE GOT A"
2380 GOTO 2400
2390 PRINT " 21.1.1. ZOMBIE GOT A"
2400 GOTO 2420
2410 PRINT " 21.1.1. ZOMBIE GOT A"
2420 GOTO 2440
2430 PRINT " 21.1.1. ZOMBIE GOT A"
2440 GOTO 2460
2450 PRINT " 21.1.1. ZOMBIE GOT A"
2460 GOTO 2480
2470 PRINT " 21.1.1. ZOMBIE GOT A"
2480 GOTO 2500
2490 PRINT " 21.1.1. ZOMBIE GOT A"
2500 GOTO 2520
2510 PRINT " 21.1.1. ZOMBIE GOT A"
2520 GOTO 2540
2530 PRINT " 21.1.1. ZOMBIE GOT A"
2540 GOTO 2560
2550 PRINT " 21.1.1. ZOMBIE GOT A"
2560 GOTO 2580
2570 PRINT " 21.1.1. ZOMBIE GOT A"
2580 GOTO 2600
2590 PRINT " 21.1.1. ZOMBIE GOT A"
2600 GOTO 2620
2610 PRINT " 21.1.1. ZOMBIE GOT A"
2620 GOTO 2640
2630 PRINT " 21.1.1. ZOMBIE GOT A"
2640 GOTO 2660
2650 PRINT " 21.1.1. ZOMBIE GOT A"
2660 GOTO 2680
2670 PRINT " 21.1.1. ZOMBIE GOT A"
2680 GOTO 2700
2690 PRINT " 21.1.1. ZOMBIE GOT A"
2700 GOTO 2720
2710 PRINT " 21.1.1. ZOMBIE GOT A"
2720 GOTO 2740
2730 PRINT " 21.1.1. ZOMBIE GOT A"
2740 GOTO 2760
2750 PRINT " 21.1.1. ZOMBIE GOT A"
2760 GOTO 2780
2770 PRINT " 21.1.1. ZOMBIE GOT A"
2780 GOTO 2800
2790 PRINT " 21.1.1. ZOMBIE GOT A"
2800 GOTO 2820
2810 PRINT " 21.1.1. ZOMBIE GOT A"
2820 GOTO 2840
2830 PRINT " 21.1.1. ZOMBIE GOT A"
2840 GOTO 2860
2850 PRINT " 21.1.1. ZOMBIE GOT A"
2860 GOTO 2880
2870 PRINT " 21.1.1. ZOMBIE GOT A"
2880 GOTO 2900
2890 PRINT " 21.1.1. ZOMBIE GOT A"
2900 GOTO 2920
2910 PRINT " 21.1.1. ZOMBIE GOT A"
2920 GOTO 2940
2930 PRINT " 21.1.1. ZOMBIE GOT A"
2940 GOTO 2960
2950 PRINT " 21.1.1. ZOMBIE GOT A"
2960 GOTO 2980
2970 PRINT " 21.1.1. ZOMBIE GOT A"
2980 GOTO 3000
2990 PRINT " 21.1.1. ZOMBIE GOT A"
3000 GOTO 3020
3010 PRINT " 21.1
```



**Available at  
your  
newsagent –  
NOW**

POPULAR  
**Computing**  
WEEKLY

HOBHOUSE COURT, 19 WHITCOMB STREET WC2

**Every week for 30p**

### Competitions

To tease and squeeze the best out of your rapidly developing computer brain.

## Programming

To help you build your knowledge of sophisticated techniques, step by step the secrets of the pros will be unfolded.

### Clubs

What's happening inside Britain's mushrooming macro club world. Interviews and profiles of the new computing breed.

## Newport

A really fast up-to-the-minute analysis of all that's going on

in the expanding world of micro technology

## Reviews

A panel of experts assess the latest products both sold and seen as and when they become available

### Programs

Readers own programs published each week with prizes for the best entries.

## Questions

Answered by an expert who knows  
In short, it's a package you can't  
afford to be without. Make sure, place  
an order with your newspaper.



# Programming

## Knowing where the next byte is coming from

*Stephen Devine explains how to squeeze programs into 1K by memory-saving techniques*

ZX81 owners are often disappointed by the lack of memory on the basic machine. They often find themselves with programs which are just too long to fit within the available 1K. However, by using various memory saving techniques it is often possible to sufficiently shorten these programs so that they can be run in 1K.

Since the method of storing floating point numbers on the ZX81 uses six bytes for each number, considerable savings in memory can be obtained by replacing all of the numbers in a program (except the line numbers) by equivalent symbols. If the numbers 0 and 1 are replaced by NOT PI and SGN PI respectively then four bytes are saved each time.

For single- or double-digit numbers the VAL function can be used. For example, VAL "4" saves two bytes since the digit 4 is stored as a string and not as a floating point number.

There are more ways to find extra bytes than the addition of a RAM pack.

The CODE function can be used for even larger numbers, provided that there is a symbol in the character set which corresponds to the number to be replaced. For example, CODE IF will replace the number 250.

If the same number is used repeatedly throughout a program then it may be worthwhile assigning that number to a variable in the start-up line program and using the variable each time the number is required. If the number 500 appears repeatedly in a program then it could first be assigned to a variable by, say, LET N = 500. Then statements such as LET X = X + 500 could be replaced by LET X = X + N, saving five bytes each time.

Replacing all the literal numbers in a program will often save enough memory to enable the program to be run successfully but, if not, there are some further techniques which can be applied.

One method of saving memory is to reduce the memory requirements of conditional statements. For example, a statement of the form: IF A = X THEN LET B = B + 1 can be replaced by LET P = P + (A=X).

With a saving of six bytes. Much used statements in arcade type games are those using the INKEY function such as:  
10 IF INKEY = 0 THEN LET X = X + 1  
20 IF INKEY = 5 THEN LET X = X - 1

which might be used to move an object

back and forth across the screen. These can be replaced by the single statement:  
10 LET X = X + (INKEY = 0) - (INKEY = 5) ;  
saving 20 bytes each time. If the variable is to be incremented or decremented by more than one then the parentheses can be multiplied by the required number, for example:

```
10 IF INKEY = 0 THEN LET Y = Y + 2  
20 IF INKEY = 7 THEN LET Y = Y - 2
```

can be replaced by

```
10 LET Y = Y + VAL "2" *  
INKEY = 0 - INKEY = 7 ;
```

saving thirteen bytes.

Many PRINT statements can also be modified to consume less memory. For example, when printing instructions many words can often be replaced by single byte keywords.

### Single stroke keywords

Take the statement PRINT "ENTER YOUR NAME". This can be replaced by the equivalent PRINT "INPUT YOUR NAME", where INPUT is entered as a single-stroke keyword. This saves six bytes, since the spaces before and after the word INPUT are free. Many more keywords such as IF, OR, TO, AND, THEN and others can also be used in this way. However, the oblique contain words to END entered, it may be necessary to first enter THEN and end it out afterwards.

When a text of concurrent lines is to be printed, such as

```
10 PRINT  
20 PRINT  
30 PRINT
```

it can be replaced by

```
10 PRINT
```

which, in this case, saves six bytes.

It should also be remembered that GOTO, and GOSUB's need not be assigned a literal numerical value, such as GOTO 100, but can be used with functions. For example the routine

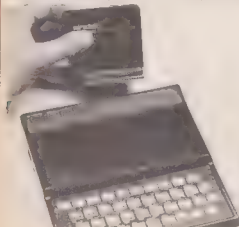
```
10 IF X THEN GOTO 100  
20 IF X THEN GOTO 200  
30 IF X THEN GOTO 300
```

can be replaced by the single statement  
10 GOTO 100-X

saving a massive 40 bytes.

By using some or all of the techniques outlined above and by experimenting with others you should find that there are few short programs which cannot be squeezed into 1K. Even some larger ones, which would normally use up to 2K of memory, can be effectively halved and run in 1K.

If a 16K RAM pack is added to the basic machine, the conservative use of memory should not be neglected. It makes for very efficient programming and, even with 16K of memory, there will still be some programs which are just that little bit too long.



# Spectrum

In this new slot various contributors explore different aspects of the ZX Spectrum.

## Making these graph-ics is easy as pie!

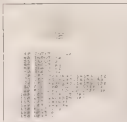
*Nick Hampshire explains how to put different shapes into your circles*

Line 10 Location of centre of disc on screen  
Line 20 Radius of disc  
Line 30 Increment of radius between circles

The simple way to draw a disc is to use the **CIRCLE** command in a program loop. This varies the radius from the centre of the disc to the outside perimeter, thereby drawing a set of concentric circles. The distance between each concentric circle can be varied by changing the step value in the radius increment loop.

This method will accurately draw a high resolution disc on the screen, but it has two drawbacks: (a) the spacing between the dots in each concentric circle cannot be varied, and (b) it is impossible to draw a segment of a disc.

These drawbacks are overcome by the following program:

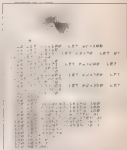


40 Plot centre co-ordinates  
50 Radius  
60 Spacing between dots in a circle

In this program lines 70 to 100 draw a circle on the screen at centre co-ordinates  $x_0, y_0$ , of a radius  $r_0$  and with a spacing between the dots of  $dp$  degrees. It should be noted that line 70 converts the degree angle dot increment into radians.

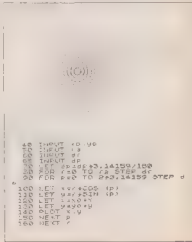
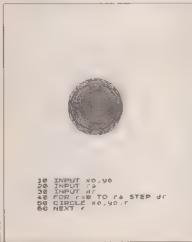
80 beginning angle of segment  
90 end angle of segment

A variation of the previous program can be used to draw this segment of a disc. This requires two new parameters — the beginning angle of the segment and the end angle.

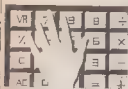


By using a combination of different segments, each with different dot densities, you can draw pie charts — a useful way of graphically representing data. The following program draws such a chart:

10 set centre to screen co-ordinates  $x_0=100, y_0=100$   
12 set radius of full disc to 40.  
14-54 the data used for each segment. This is in the following form:  $p1$  = start angle,  $p2$  = end angle (degrees),  $l$  = number of segments or wedge sizes,  $dp$  and  $dy$  determine the dot spacing and therefore the density of the wedge.  
70-100 the sub-routines to draw a disc segment



# Hand & mouth



## Down to the bare essentials

A hand of mine recently received a clever little badge proclaiming "RPN OK RULES". Now we all know that RPN—or Reverse Polish Notation—stands for the system of calculation in Hewlett Packard calculators and that everybody argues as to whether it is far easier or far worse than the "Algebraic Logic" systems of other machines. Have you ever wondered about the derivation of this odd term?

Well the connection with Poland comes from a man by the name of Jan Łukasiewicz, who was born in the Polish city of Łódź in 1878. He was a logician and mathematician, as well as an admired and influential teacher, who eventually died in exile in Dublin in 1956. He arrived, at an early stage, at the conception of calculat-



ing the truth value of a logical statement—True, False or Don't Know—which is now seen in the Boolean Logic tables familiar to computing buffs.

His attempts to strip things down to only the bare essentials were highlighted in his "Polish Notation". This notation simplifies the evaluation of arithmetical expressions by eliminating parentheses and all punctuation.

Hewlett Packard have modified this by

specifying the operation to be performed after the entry of variables, as opposed to before as on the "Polish system" (Hence Reverse Polish Notation).

Łukasiewicz was no mean writer, too, so I'll leave the last words to him: "Just as art grew out of the craving for beauty, science was created by the urge for knowledge. The saying 'art for art's sake' and 'science for science's sake' are equally valid."

John Gawrie



## Make macro moves on your micro

If you are writing a long program in assembly language you will find inevitably that some sections of the program are repeated more than once.

A macro assembler is simply a program with all the assembler features I have described in previous articles and the additional facility of assigning a name to a group of commands. For example, you could write a macro to set two zero page locations to a particular address:

```
MACRO1 LDA #000
STA REFERENCE,X
LDA #000
STA REFERENCE,X
```

Whenever you want to use those instructions you simply insert the instruction

## MACRO1 into your source code listing

```
START LDA #1
MACRO1
LDA #2
MACRO1
LDA #3
MACRO1
```

When you assemble the program the machine code instruction defined by the macro source code (1) will be inserted in the right place, with all the relative jumps worked out automatically.

A simpler version of the same idea is a facility to copy a block of source code lines from one place to another. In this case you will see some instructions in the source code listing between two assembler directives.

A macro assembler may seem much like using a call to a subroutine. This is not the case. A macro is an assembly-time facility while a subroutine is an execution-time function. Using a macro command to insert object code uses more memory than calling a subroutine but produces machine code that will run faster.

The Jump to Subroutine (JSR) and Return from Subroutine (RTS) instructions each take 6 microseconds in a system using a 1MHz clock. If you have saved the CPU registers at the beginning of the SR and restored them at the end, that will add a further 36 microseconds. By

contrast, a macro command uses as much RAM as the component instructions demand on each occasion, while a call to a subroutine only takes three bytes.

The time penalty imposed by subroutines calls can give you a measure of the efficiency of the program. Suppose you wrote a subroutine to double the contents of a zero page location:

1. PHP Push CPU status
2. PHA Push the accumulator
3. LDA WHEAT Load the accumulator with WHEAT
4. ASLA Shift the accumulator left
5. STA WHEAT Store result in WHEAT
6. PLA Pull the accumulator
7. POP Restore the CPU status
8. RTS

You can see that three instructions (lines 3,4,5) carry out the function of the SR and the others would not be present in a macro command.

The percentage inefficiency is calculated thus:

$$\% \text{ inefficiency} = \frac{\text{Total} - \text{Body}}{\text{Body}} \times 100$$

If you add up the microseconds for each instruction in the program above, you get the result:

$$\frac{28 - 8}{8} \times 100 = 250\% \text{ inefficiency}$$

John Dawson

# Sound & vision



## Stringalonga maximum trickery!

The three routines listed will enable you to manipulate a string array containing a full screen image of 704 bytes. First of all, however, you need to put your string together. This can be done as follows. First set RAMTOP with the following three commands:

```
POKE 16320,0
POKE 16319,125
NEW
```

Now LOAD any program which produces an interesting screen image. Then add the following subroutine to that program. I have numbered the subroutine to start at 5000, but you can use any convenient numbers.

```
5000 LET 0 = 1 + PEEK 16320 + 256 * PEEK 16319
5010 FOR I = 0 TO 100
5020 POINT 50000 + PEEK 10 + INT (500)
5030 NEXT I
5040 RETURN
```

You will also need to add some method of calling that subroutine when a suitable image is displayed on the screen. RUN the program and, when you have a good image, call the subroutine. (What it has run

its course STOP the program and clear it by pressing NEW. Provided you do not turn off the power, the image will remain in store over RAMTOP.

The next step is to call this image into a string:

```
10 LET AS =
20 FOR I = 32000 TO 32720
30 LET AS+AS+CHR PEEK I
40 NEXT I
50 PRINT AS
```

RUN the program and the image will be displayed. From now on, it is important not to use CLEAR or RUN, as these will lose AS. Press newline, and write the following program over the existing one (note that the contents of AS must be the graphics characters represented on the keys in line 20):

```
10 LET AS =
11 FOR I = 1
12 LET AS =
13 LET AS =
14 LET AS =
15 LET AS =
16 LET AS =
17 LET AS =
18 LET AS =
19 LET AS =
20 LET AS =
21 LET AS =
22 LET AS =
23 LET AS =
24 LET AS =
25 LET AS =
26 LET AS =
27 LET AS =
28 LET AS =
29 LET AS =
30 LET AS =
31 LET AS =
32 LET AS =
33 LET AS =
34 LET AS =
35 LET AS =
36 LET AS =
37 LET AS =
38 LET AS =
39 LET AS =
40 LET AS =
41 LET AS =
42 LET AS =
43 LET AS =
44 LET AS =
45 LET AS =
46 LET AS =
47 LET AS =
48 LET AS =
49 LET AS =
50 LET AS =
51 LET AS =
52 LET AS =
53 LET AS =
54 LET AS =
55 LET AS =
56 LET AS =
57 LET AS =
58 LET AS =
59 LET AS =
60 LET AS =
61 LET AS =
62 LET AS =
63 LET AS =
64 LET AS =
65 LET AS =
66 LET AS =
67 LET AS =
68 LET AS =
69 LET AS =
70 LET AS =
71 LET AS =
72 LET AS =
73 LET AS =
74 LET AS =
75 LET AS =
76 LET AS =
77 LET AS =
78 LET AS =
79 LET AS =
80 LET AS =
81 LET AS =
82 LET AS =
83 LET AS =
84 LET AS =
85 LET AS =
86 LET AS =
87 LET AS =
88 LET AS =
89 LET AS =
90 LET AS =
91 LET AS =
92 LET AS =
93 LET AS =
94 LET AS =
95 LET AS =
96 LET AS =
97 LET AS =
98 LET AS =
99 LET AS =
100 LET AS =
101 LET AS =
102 LET AS =
103 LET AS =
104 LET AS =
105 LET AS =
106 LET AS =
107 LET AS =
108 LET AS =
109 LET AS =
110 LET AS =
111 LET AS =
112 LET AS =
113 LET AS =
114 LET AS =
115 LET AS =
116 LET AS =
117 LET AS =
118 LET AS =
119 LET AS =
120 LET AS =
121 LET AS =
122 LET AS =
123 LET AS =
124 LET AS =
125 LET AS =
126 LET AS =
127 LET AS =
128 LET AS =
129 LET AS =
130 LET AS =
131 LET AS =
132 LET AS =
133 LET AS =
134 LET AS =
135 LET AS =
136 LET AS =
137 LET AS =
138 LET AS =
139 LET AS =
140 LET AS =
141 LET AS =
142 LET AS =
143 LET AS =
144 LET AS =
145 LET AS =
146 LET AS =
147 LET AS =
148 LET AS =
149 LET AS =
150 LET AS =
151 LET AS =
152 LET AS =
153 LET AS =
154 LET AS =
155 LET AS =
156 LET AS =
157 LET AS =
158 LET AS =
159 LET AS =
160 LET AS =
161 LET AS =
162 LET AS =
163 LET AS =
164 LET AS =
165 LET AS =
166 LET AS =
167 LET AS =
168 LET AS =
169 LET AS =
170 LET AS =
171 LET AS =
172 LET AS =
173 LET AS =
174 LET AS =
175 LET AS =
176 LET AS =
177 LET AS =
178 LET AS =
179 LET AS =
180 LET AS =
181 LET AS =
182 LET AS =
183 LET AS =
184 LET AS =
185 LET AS =
186 LET AS =
187 LET AS =
188 LET AS =
189 LET AS =
190 LET AS =
191 LET AS =
192 LET AS =
193 LET AS =
194 LET AS =
195 LET AS =
196 LET AS =
197 LET AS =
198 LET AS =
199 LET AS =
200 LET AS =
201 LET AS =
202 LET AS =
203 LET AS =
204 LET AS =
205 LET AS =
206 LET AS =
207 LET AS =
208 LET AS =
209 LET AS =
210 LET AS =
211 LET AS =
212 LET AS =
213 LET AS =
214 LET AS =
215 LET AS =
216 LET AS =
217 LET AS =
218 LET AS =
219 LET AS =
220 LET AS =
221 LET AS =
222 LET AS =
223 LET AS =
224 LET AS =
225 LET AS =
226 LET AS =
227 LET AS =
228 LET AS =
229 LET AS =
230 LET AS =
231 LET AS =
232 LET AS =
233 LET AS =
234 LET AS =
235 LET AS =
236 LET AS =
237 LET AS =
238 LET AS =
239 LET AS =
240 LET AS =
241 LET AS =
242 LET AS =
243 LET AS =
244 LET AS =
245 LET AS =
246 LET AS =
247 LET AS =
248 LET AS =
249 LET AS =
250 LET AS =
251 LET AS =
252 LET AS =
253 LET AS =
254 LET AS =
255 LET AS =
256 LET AS =
257 LET AS =
258 LET AS =
259 LET AS =
260 LET AS =
261 LET AS =
262 LET AS =
263 LET AS =
264 LET AS =
265 LET AS =
266 LET AS =
267 LET AS =
268 LET AS =
269 LET AS =
270 LET AS =
271 LET AS =
272 LET AS =
273 LET AS =
274 LET AS =
275 LET AS =
276 LET AS =
277 LET AS =
278 LET AS =
279 LET AS =
280 LET AS =
281 LET AS =
282 LET AS =
283 LET AS =
284 LET AS =
285 LET AS =
286 LET AS =
287 LET AS =
288 LET AS =
289 LET AS =
290 LET AS =
291 LET AS =
292 LET AS =
293 LET AS =
294 LET AS =
295 LET AS =
296 LET AS =
297 LET AS =
298 LET AS =
299 LET AS =
300 LET AS =
301 LET AS =
302 LET AS =
303 LET AS =
304 LET AS =
305 LET AS =
306 LET AS =
307 LET AS =
308 LET AS =
309 LET AS =
310 LET AS =
311 LET AS =
312 LET AS =
313 LET AS =
314 LET AS =
315 LET AS =
316 LET AS =
317 LET AS =
318 LET AS =
319 LET AS =
320 LET AS =
321 LET AS =
322 LET AS =
323 LET AS =
324 LET AS =
325 LET AS =
326 LET AS =
327 LET AS =
328 LET AS =
329 LET AS =
330 LET AS =
331 LET AS =
332 LET AS =
333 LET AS =
334 LET AS =
335 LET AS =
336 LET AS =
337 LET AS =
338 LET AS =
339 LET AS =
340 LET AS =
341 LET AS =
342 LET AS =
343 LET AS =
344 LET AS =
345 LET AS =
346 LET AS =
347 LET AS =
348 LET AS =
349 LET AS =
350 LET AS =
351 LET AS =
352 LET AS =
353 LET AS =
354 LET AS =
355 LET AS =
356 LET AS =
357 LET AS =
358 LET AS =
359 LET AS =
360 LET AS =
361 LET AS =
362 LET AS =
363 LET AS =
364 LET AS =
365 LET AS =
366 LET AS =
367 LET AS =
368 LET AS =
369 LET AS =
370 LET AS =
371 LET AS =
372 LET AS =
373 LET AS =
374 LET AS =
375 LET AS =
376 LET AS =
377 LET AS =
378 LET AS =
379 LET AS =
380 LET AS =
381 LET AS =
382 LET AS =
383 LET AS =
384 LET AS =
385 LET AS =
386 LET AS =
387 LET AS =
388 LET AS =
389 LET AS =
390 LET AS =
391 LET AS =
392 LET AS =
393 LET AS =
394 LET AS =
395 LET AS =
396 LET AS =
397 LET AS =
398 LET AS =
399 LET AS =
400 LET AS =
401 LET AS =
402 LET AS =
403 LET AS =
404 LET AS =
405 LET AS =
406 LET AS =
407 LET AS =
408 LET AS =
409 LET AS =
410 LET AS =
411 LET AS =
412 LET AS =
413 LET AS =
414 LET AS =
415 LET AS =
416 LET AS =
417 LET AS =
418 LET AS =
419 LET AS =
420 LET AS =
421 LET AS =
422 LET AS =
423 LET AS =
424 LET AS =
425 LET AS =
426 LET AS =
427 LET AS =
428 LET AS =
429 LET AS =
430 LET AS =
431 LET AS =
432 LET AS =
433 LET AS =
434 LET AS =
435 LET AS =
436 LET AS =
437 LET AS =
438 LET AS =
439 LET AS =
440 LET AS =
441 LET AS =
442 LET AS =
443 LET AS =
444 LET AS =
445 LET AS =
446 LET AS =
447 LET AS =
448 LET AS =
449 LET AS =
450 LET AS =
451 LET AS =
452 LET AS =
453 LET AS =
454 LET AS =
455 LET AS =
456 LET AS =
457 LET AS =
458 LET AS =
459 LET AS =
460 LET AS =
461 LET AS =
462 LET AS =
463 LET AS =
464 LET AS =
465 LET AS =
466 LET AS =
467 LET AS =
468 LET AS =
469 LET AS =
470 LET AS =
471 LET AS =
472 LET AS =
473 LET AS =
474 LET AS =
475 LET AS =
476 LET AS =
477 LET AS =
478 LET AS =
479 LET AS =
480 LET AS =
481 LET AS =
482 LET AS =
483 LET AS =
484 LET AS =
485 LET AS =
486 LET AS =
487 LET AS =
488 LET AS =
489 LET AS =
490 LET AS =
491 LET AS =
492 LET AS =
493 LET AS =
494 LET AS =
495 LET AS =
496 LET AS =
497 LET AS =
498 LET AS =
499 LET AS =
500 LET AS =
501 LET AS =
502 LET AS =
503 LET AS =
504 LET AS =
505 LET AS =
506 LET AS =
507 LET AS =
508 LET AS =
509 LET AS =
510 LET AS =
511 LET AS =
512 LET AS =
513 LET AS =
514 LET AS =
515 LET AS =
516 LET AS =
517 LET AS =
518 LET AS =
519 LET AS =
520 LET AS =
521 LET AS =
522 LET AS =
523 LET AS =
524 LET AS =
525 LET AS =
526 LET AS =
527 LET AS =
528 LET AS =
529 LET AS =
530 LET AS =
531 LET AS =
532 LET AS =
533 LET AS =
534 LET AS =
535 LET AS =
536 LET AS =
537 LET AS =
538 LET AS =
539 LET AS =
540 LET AS =
541 LET AS =
542 LET AS =
543 LET AS =
544 LET AS =
545 LET AS =
546 LET AS =
547 LET AS =
548 LET AS =
549 LET AS =
550 LET AS =
551 LET AS =
552 LET AS =
553 LET AS =
554 LET AS =
555 LET AS =
556 LET AS =
557 LET AS =
558 LET AS =
559 LET AS =
560 LET AS =
561 LET AS =
562 LET AS =
563 LET AS =
564 LET AS =
565 LET AS =
566 LET AS =
567 LET AS =
568 LET AS =
569 LET AS =
570 LET AS =
571 LET AS =
572 LET AS =
573 LET AS =
574 LET AS =
575 LET AS =
576 LET AS =
577 LET AS =
578 LET AS =
579 LET AS =
580 LET AS =
581 LET AS =
582 LET AS =
583 LET AS =
584 LET AS =
585 LET AS =
586 LET AS =
587 LET AS =
588 LET AS =
589 LET AS =
590 LET AS =
591 LET AS =
592 LET AS =
593 LET AS =
594 LET AS =
595 LET AS =
596 LET AS =
597 LET AS =
598 LET AS =
599 LET AS =
600 LET AS =
601 LET AS =
602 LET AS =
603 LET AS =
604 LET AS =
605 LET AS =
606 LET AS =
607 LET AS =
608 LET AS =
609 LET AS =
610 LET AS =
611 LET AS =
612 LET AS =
613 LET AS =
614 LET AS =
615 LET AS =
616 LET AS =
617 LET AS =
618 LET AS =
619 LET AS =
620 LET AS =
621 LET AS =
622 LET AS =
623 LET AS =
624 LET AS =
625 LET AS =
626 LET AS =
627 LET AS =
628 LET AS =
629 LET AS =
630 LET AS =
631 LET AS =
632 LET AS =
633 LET AS =
634 LET AS =
635 LET AS =
636 LET AS =
637 LET AS =
638 LET AS =
639 LET AS =
640 LET AS =
641 LET AS =
642 LET AS =
643 LET AS =
644 LET AS =
645 LET AS =
646 LET AS =
647 LET AS =
648 LET AS =
649 LET AS =
650 LET AS =
651 LET AS =
652 LET AS =
653 LET AS =
654 LET AS =
655 LET AS =
656 LET AS =
657 LET AS =
658 LET AS =
659 LET AS =
660 LET AS =
661 LET AS =
662 LET AS =
663 LET AS =
664 LET AS =
665 LET AS =
666 LET AS =
667 LET AS =
668 LET AS =
669 LET AS =
670 LET AS =
671 LET AS =
672 LET AS =
673 LET AS =
674 LET AS =
675 LET AS =
676 LET AS =
677 LET AS =
678 LET AS =
679 LET AS =
680 LET AS =
681 LET AS =
682 LET AS =
683 LET AS =
684 LET AS =
685 LET AS =
686 LET AS =
687 LET AS =
688 LET AS =
689 LET AS =
690 LET AS =
691 LET AS =
692 LET AS =
693 LET AS =
694 LET AS =
695 LET AS =
696 LET AS =
697 LET AS =
698 LET AS =
699 LET AS =
700 LET AS =
701 LET AS =
702 LET AS =
703 LET AS =
704 LET AS =
705 LET AS =
706 LET AS =
707 LET AS =
708 LET AS =
709 LET AS =
710 LET AS =
711 LET AS =
712 LET AS =
713 LET AS =
714 LET AS =
715 LET AS =
716 LET AS =
717 LET AS =
718 LET AS =
719 LET AS =
720 LET AS =
721 LET AS =
722 LET AS =
723 LET AS =
724 LET AS =
725 LET AS =
726 LET AS =
727 LET AS =
728 LET AS =
729 LET AS =
730 LET AS =
731 LET AS =
732 LET AS =
733 LET AS =
734 LET AS =
735 LET AS =
736 LET AS =
737 LET AS =
738 LET AS =
739 LET AS =
740 LET AS =
741 LET AS =
742 LET AS =
743 LET AS =
744 LET AS =
745 LET AS =
746 LET AS =
747 LET AS =
748 LET AS =
749 LET AS =
750 LET AS =
751 LET AS =
752 LET AS =
753 LET AS =
754 LET AS =
755 LET AS =
756 LET AS =
757 LET AS =
758 LET AS =
759 LET AS =
760 LET AS =
761 LET AS =
762 LET AS =
763 LET AS =
764 LET AS =
765 LET AS =
766 LET AS =
767 LET AS =
768 LET AS =
769 LET AS =
770 LET AS =
771 LET AS =
772 LET AS =
773 LET AS =
774 LET AS =
775 LET AS =
776 LET AS =
777 LET AS =
778 LET AS =
779 LET AS =
780 LET AS =
781 LET AS =
782 LET AS =
783 LET AS =
784 LET AS =
785 LET AS =
786 LET AS =
787 LET AS =
788 LET AS =
789 LET AS =
790 LET AS =
791 LET AS =
792 LET AS =
793 LET AS =
794 LET AS =
795 LET AS =
796 LET AS =
797 LET AS =
798 LET AS =
799 LET AS =
800 LET AS =
801 LET AS =
802 LET AS =
803 LET AS =
804 LET AS =
805 LET AS =
806 LET AS =
807 LET AS =
808 LET AS =
809 LET AS =
810 LET AS =
811 LET AS =
812 LET AS =
813 LET AS =
814 LET AS =
815 LET AS =
816 LET AS =
817 LET AS =
818 LET AS =
819 LET AS =
820 LET AS =
821 LET AS =
822 LET AS =
823 LET AS =
824 LET AS =
825 LET AS =
826 LET AS =
827 LET AS =
828 LET AS =
829 LET AS =
830 LET AS =
831 LET AS =
832 LET AS =
833 LET AS =
834 LET AS =
835 LET AS =
836 LET AS =
837 LET AS =
838 LET AS =
839 LET AS =
840 LET AS =
841 LET AS =
842 LET AS =
843 LET AS =
844 LET AS =
845 LET AS =
846 LET AS =
847 LET AS =
848 LET AS =
849 LET AS =
850 LET AS =
851 LET AS =
852 LET AS =
853 LET AS =
854 LET AS =
855 LET AS =
856 LET AS =
857 LET AS =
858 LET AS =
859 LET AS =
860 LET AS =
861 LET AS =
862 LET AS =
863 LET AS =
864 LET AS =
865 LET AS =
866 LET AS =
867 LET AS =
868 LET AS =
869 LET AS =
870 LET AS =
871 LET AS =
872 LET AS =
873 LET AS =
874 LET AS =
875 LET AS =
876 LET AS =
877 LET AS =
878 LET AS =
879 LET AS =
880 LET AS =
881 LET AS =
882 LET AS =
883 LET AS =
884 LET AS =
885 LET AS =
886 LET AS =
887 LET AS =
888 LET AS =
889 LET AS =
890 LET AS =
891 LET AS =
892 LET AS =
893 LET AS =
894 LET AS =
895 LET AS =
896 LET AS =
897 LET AS =
898 LET AS =
899 LET AS =
900 LET AS =
901 LET AS =
902 LET AS =
903 LET AS =
904 LET AS =
905 LET AS =
906 LET AS =
907 LET AS =
908 LET AS =
909 LET AS =
910 LET AS =
911 LET AS =
912 LET AS =
913 LET AS =
914 LET AS =
915 LET AS =
916 LET AS =
917 LET AS =
918 LET AS =
919 LET AS =
920 LET AS =
921 LET AS =
922 LET AS =
923 LET AS =
924 LET AS =
925 LET AS =
926 LET AS =
927 LET AS =
928 LET AS =
929 LET AS =
930 LET AS =
931 LET AS =
932 LET AS =
933 LET AS =
934 LET AS =
935 LET AS =
936 LET AS =
937 LET AS =
938 LET AS =
939 LET AS =
940 LET AS =
941 LET AS =
942 LET AS =
943 LET AS =
944 LET AS =
945 LET AS =
946 LET AS =
947 LET AS =
948 LET AS =
949 LET AS =
950 LET AS =
951 LET AS =
952 LET AS =
953 LET AS =
954 LET AS =
955 LET AS =
956 LET AS =
957 LET AS =
958 LET AS =
959 LET AS =
960 LET AS =
961 LET AS =
962 LET AS =
963 LET AS =
964 LET AS =
965 LET AS =
966 LET AS =
967 LET AS =
968 LET AS =
969 LET AS =
970 LET AS =
971 LET AS =
972 LET AS =
973 LET AS =
974 LET AS =
975 LET AS =
976 LET AS =
977 LET AS =
978 LET AS =
979 LET AS =
980 LET AS =
981 LET AS =
982 LET AS =
983 LET AS =
984 LET AS =
985 LET AS =
986 LET AS =
987 LET AS =
988 LET AS =
989 LET AS =
990 LET AS =
991 LET AS =
992 LET AS =
993 LET AS =
994 LET AS =
995 LET AS =
996 LET AS =
997 LET AS =
998 LET AS =
999 LET AS =
1000 LET AS =
```

To operate this program, use GOTO 1. The screen image will be printed as before, but with one important difference — it has been reversed left to right.

The key to the system is the string set up in line 20. This ensures that those charac-

ters which are asymmetrical (apart from letters and numbers) are reversed to preserve the integrity of the image. Any words or numbers will be reproduced backwards.

A similar device is used in the next routine, which has the effect of turning the image through 180 degrees. This routine is exactly the same as About Turn, except for the following lines which should be altered. As with About Turn, the numbers and letters in the string in line 20 represent the graphics characters which are to be found on those keys. Again, do not RUN the program, but GOTO 1.

```
10 LET AS =
20 LET AS =
30 LET AS =
40 LET AS =
50 LET AS =
60 LET AS =
70 LET AS =
80 LET AS =
90 LET AS =
100 LET AS =
110 LET AS =
120 LET AS =
130 LET AS =
140 LET AS =
150 LET AS =
160 LET AS =
170 LET AS =
180 LET AS =
190 LET AS =
200 LET AS =
210 LET AS =
220 LET AS =
230 LET AS =
240 LET AS =
250 LET AS =
260 LET AS =
270 LET AS =
280 LET AS =
290 LET AS =
300 LET AS =
310 LET AS =
320 LET AS =
330 LET AS =
340 LET AS =
350 LET AS =
360 LET AS =
370 LET AS =
380 LET AS =
390 LET AS =
400 LET AS =
410 LET AS =
420 LET AS =
430 LET AS =
440 LET AS =
450 LET AS =
460 LET AS =
470 LET AS =
480 LET AS =
490 LET AS =
500 LET AS =
510 LET AS =
520 LET AS =
530 LET AS =
540 LET AS =
550 LET AS =
560 LET AS =
570 LET AS =
580 LET AS =
590 LET AS =
600 LET AS =
610 LET AS =
620 LET AS =
630 LET AS =
640 LET AS =
650 LET AS =
660 LET AS =
670 LET AS =
680 LET AS =
690 LET AS =
700 LET AS =
710 LET AS =
720 LET AS =
730 LET AS =
740 LET AS =
750 LET AS =
760 LET AS =
770 LET AS =
780 LET AS =
790 LET AS =
800 LET AS =
810 LET AS =
820 LET AS =
830 LET AS =
840 LET AS =
850 LET AS =
860 LET AS =
870 LET AS =
880 LET AS =
890 LET AS =
900 LET AS =
910 LET AS =
920 LET AS =
930 LET AS =
940 LET AS =
950 LET AS =
960 LET AS =
970 LET AS =
980 LET AS =
990 LET AS =
1000 LET AS =
```

This routine produces a straightforward reversal top to bottom. It is like some as Tricky Turnover except for the following lines. The characters in the string in line 20 represent the graphics characters found on those keys.

```
10 LET AS =
20 LET AS =
30 LET AS =
40 LET AS =
50 LET AS =
60 LET AS =
70 LET AS =
80 LET AS =
90 LET AS =
100 LET AS =
110 LET AS =
120 LET AS =
130 LET AS =
140 LET AS =
150 LET AS =
160 LET AS =
170 LET AS =
180 LET AS =
190 LET AS =
200 LET AS =
210 LET AS =
220 LET AS =
230 LET AS =
240 LET AS =
250 LET AS =
260 LET AS =
270 LET AS =
280 LET AS =
290 LET AS =
300 LET AS =
310 LET AS =
320 LET AS =
330 LET AS =
340 LET AS =
350 LET AS =
360 LET AS =
370 LET AS =
380 LET AS =
390 LET AS =
400 LET AS =
410 LET AS =
420 LET AS =
430 LET AS =
440 LET AS =
450 LET AS =
460 LET AS =
470 LET AS =
480 LET AS =
490 LET AS =
500 LET AS =
510 LET AS =
520 LET AS =
530 LET AS =
540 LET AS =
550 LET AS =
560 LET AS =
570 LET AS =
580 LET AS =
590 LET AS =
600 LET AS =
610 LET AS =
620 LET AS =
630 LET AS =
640 LET AS =
650 LET AS =
660 LET AS =
670 LET AS =
680 LET AS =
690 LET AS =
700 LET AS =
710 LET AS =
720 LET AS =
730 LET AS =
740 LET AS =
750 LET AS =
760 LET AS =
770 LET AS =
780 LET AS =
790 LET AS =
800 LET AS =
810 LET AS =
820 LET AS =
830 LET AS =
840 LET AS =
850 LET AS =
860 LET AS =
870 LET AS =
880 LET AS =
890 LET AS =
900 LET AS =
910 LET AS =
920 LET AS =
930 LET AS =
940 LET AS =
950 LET AS =
960 LET AS =
970 LET AS =
980 LET AS =
990 LET AS =
1000 LET AS =
```

The same rules apply as for the other routines — GOTO 1, not RUN — in all cases. The second image is transformed into 25, which is a total reverse 704 bytes long (60 LEN 25 = 704). Nick Godwin

## Being backwards in coming forward

This week, two programs using the important pair of commands on the BBC Micro known as VDU5 and VDU4.

Briefly, VDU5 causes the text cursor to be positioned exactly (not just to the nearest print position) in the same place as the graphics cursor. So you can print text, even in colour, anywhere on the screen.

VDU5 switches this effect on, VDU4 switches it off again.

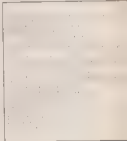
The following programs both generate luscious, curves on the screen. But they use words, not lines.

Two psychologically unsettling effects are used, one where the names of colours are written in another coloured text the other using the words FORWARD and BACK to flash back and forth on the



screen, not always doing what they say.

Finally, note that VDU19,N,C,0,0,0 is used to change colour number N to colour number C — for instance, you can



make colour 1 (normally red) become blue. The three zeroes are there for other purposes, and should always be left like that. Brian Riffin Smith



# Peek & poke

Peek your problems to our address. Ian Beardsmore will poke back an answer.

## DON'T GIVE UP ON DEAR OLD AUNT

R. Bass of Beech Road, Nantwich, Cheshire, writes

**Q** I recently received a BBC microcomputer. After trying the test Mr Reflis Smith gave in his article in your April 23 issue, I found that I have a BBC micro with the older operating system. Mr Smith said, '...doubtless all will be put right', but what do owners of such machines need to do?

Also the 'FX function is inadequately defined, and apparently is not going to be put in the guide. Where can I find out about it now? Even Peek & poke just give 'bad command'.

Lastly, when can we expect the impatiently-awaited full guide?

**A** BBC micro users need to revise the impression to give up in despair. The full guide should cover all the points you raise in more detail than I can here.

A lot of pressure has been put on the BBC, and it now seems likely that the full guide will be ready for dispatch on June 18. I am afraid that I cannot offer you much more until the guide arrives.

## JUST MAKE A NEW GEAR RESOLUTION

A. D. Huxley of Haslet Avenue, Cradley, Sussex, writes

**Q** In your review of the ZX Spectrum in the May edition you said '...screen resolution of 32 x 24 is adequate... although this can be enlarged under software control to normal teletext standard'.

Please could you explain what this means. What software? When is it available? Does it mean that adequate resolution is made sharper by this process?

**A** Teletext standard is 40 characters per line as opposed to the 32 which the spectrum will use normally. As for the software mentioned no

one is doing quite sure what is meant by that.

There is an architecture within the ROM for maintaining a teletext compatible 40 x 24 screen display list, strictly speaking, that is firmware. The typical adaptor is of owned hardware.

So far we can only hazard one of two guesses. Either the PR boys who have been telling everyone about this software have in fact confused their terms, or the teletext architecture will be accessed by an, as yet, unrevealed machine code routine. On reflection, I think that I inevitably favour the first option.

As for making the resolution sharper I doubt it. With the extra characters per line you are trying to get more, not less, into the same space. Nevertheless, indications are that the screen resolution will still be sufficiently good enough for this not to cause any problems.

## THERE'S LIFE IN THE OLD DOG YET

David Paine of Vortone Road, Pembroke Dock, Dyfed, writes

**Q** As an avid fan of the ZX81 I am very interested in its long life on the computer market. But, after reading your review of the ZX Spectrum, I am not sure whether the ZX81 will be made after the Spectrum becomes available. Please could you tell me what will happen in the ZX81?

**A** To date, approximately four hundred thousand ZX81s have been made. A few months ago Clive Sinclair signed a major publishing deal with the giant American company, Times, to make ZX81s under licence. Conservative estimates maintain that, as a result of this deal, the ZX81 will become the world's first million selling computer by the end of the year.

In this country, even if half the ZX users decide to change, it will take quite a few months for the new machines to be dispatched. Many of the

ZX81s will probably be sold second hand to first-time users, who quite naturally will be interested in ZX81 material.

So while this country will probably be the first to see the phasing out of the ZX81 there are just too many machines in use for this to be a quick process. I am sure that the ZX81 will enjoy considerable support for some time yet.

## AND THE MEMORIES STILL LINGER ON

John Brander of Felton Close, Orpington, Kent, writes

**Q** I have a ZX81 with a 16K RAM pack and have written quite a long program. I know it is too long for the standard 8k machine, but how can I find out how much actual memory it has taken?

**A** The program file starts at the address 1659H. The last address of the program file is called D-FILE which is located at addresses 1639H and 1637H. The difference between 1659H and the address in D-FILE is the number of bytes in a program. If you enter as a direct command:

PRINT PECK 1639H-1659H:PEEK 1637H-1639H

you will get the amount of bytes in your program. If you enter

PRINT PECK 1659H-255H:PEEK 1640H-1659H

you will get the number of bytes occupied by the program, off the variables and the screen. The following commands:

PRINT PECK 1639H-PEEK 1641H-255H

OR PEK 1637H:PEEK 1641H-50

will give you an idea of how many bytes you have left up with you to work at a particular time.

## IT'S ALL A QUESTION OF COMPATIBILITY

Alasdair Crawford of Morrey Drive, Stonehouse, Scotland, writes

**Q** I have a BBC microcomputer model A. Having read your review of the ZX Spectrum, I am still convinced that the BBC is the

best machine yet available. But I am very interested in the 150 ZX Microdrive. Can you please tell me if it would be possible to connect the Microdrive to the BBC Microcomputer?

**A** There is a general feeling that if the ZX Microdrive meets the quoted specifications, then it will be of far greater importance to the world of computing than the Spectrum. After all, it does seem to be something of a storage revolution.

It must, however, be borne in mind that the Microdrive has only been seen once in public, and that very briefly at the launching of the ZX Spectrum. To my knowledge, no one has had so much as a close look at it yet let alone a chance to do a thorough benchtest to analyse its full potential.

While it is due to be launched about August, Sinclair Research and Launch dates do not always coincide. So, I do not think it will be readily available until the autumn at best.

Given that the ZX printer can now be interfaced with other computers, I am sure that the Microdrive will also beed a host of compatible interfaces. Even if an interface costs £100, which I doubt, I am sure that it would sell.

A quick comparison with the New Vic disc drive will illustrate just how important this microdrive could be. With an interface costing £100, you would still get more storage with a Microdrive for almost 625K less than the Vic disc drive.

If the microdrive is not buggy, and that most will be quite a big if, then a race will be on to make it compatible with other computers. But this is several months in the future. Perhaps an early letter to Father Christmas might not come amiss.

Send your questions to Peek & poke, Popular Computing Weekly, Hobbhouse Court, 19 Whitcomb Street, London WC2 7HP.

# Competitions

## Puzzle No 10

Young David was playing with his pocket calculator the other day, when he discovered that if he multiplied 21 by 57 the answer, 1207, consisted of the same four digits, though differently arranged.

This set him thinking of how many other similar examples were possible, each having this property.

How many other sets of numbers are there?

Remember that each set must consist of two two-digit numbers which, when multiplied together produce a four-digit number formed from the same numbers, in any case, all four digits should be different.

### Solution to Puzzle No 9

The simplest way of solving this problem is to generate the values for I N C H in sequence, using four FOR/NEXT loops. The process is simplified if we realise that the value of I N C H must be greater than the square root of 10000000 (the smallest product with at least eight digits). We can therefore commence the T loop at the value 3. To put into the program extra lines is further defines the minimum value of I N C H as 3162 would probably be more involved than letting the program run from the starting value of 3000. The only point to be borne in mind is that these first few seven-digit numbers could cause an error condition in line 90 if the subtring was defined as IS TO 4. Consequently I have used the form (5 TO 4) which will permit both seven and eight digit numbers to be divided without error. Users of other forms of Basic will need to make their own adjustments.

It can only be equal to either 0, 1, 5, or 6 so lines 40-50-60 correct this.

10 FOR I = 3 TO 9

20 FOR N = 5 TO 9

30 FOR C = 9 TO 5  
40 FOR H = 5 TO 9  
50 IF H = 3 THEN LET H = 5  
60 IF H = 7 THEN NEXT C  
70 LET INCH = I \* N \* C \* H  
80 LET P = 5 \* 57 \* 100  
90 IF VAL P \$ IS TO 1 = INCH THEN PRINT INCH  
100 NEXT H  
110 NEXT C  
120 NEXT N  
130 NEXT I

Answer: INCH = 5076

### Winner of Puzzle No 8

The winner is: Ian Black, Great Wymondley, Hitchin, Herts, who receives £10.

### Solution to Crossword No 5

Across: 8 Ahh 9 Statement 10 Delirious 11 Loop 13 Memory 14 Length 17 Gold 18 Tangents 20 Dimension 21 Val.

Down: 1 Random 2 Waste my time 3 Ostery 4 Value 5 Len 6 Men of Geneva 7 Stop 12 Reagent 15 Hustle 16 Basic 17 Gods 19 It.

### Winner of Crossword No 6

The winner is: B. Turks, Chingford Hatch, London, who receives £10.

### Rules

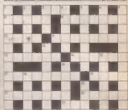
The winner of the puzzle will be the reader who, in the opinion of Popular Computing Weekly, has submitted the best solution. Preference will be shown to submissions which show how the entrant arrived at the correct answer, and to entries that indicate, in any way, how a micro might be applied.

The winner of the crossword will simply be the first name out of the hat.

The closing date for both the puzzle and the crossword is Monday, July 5.

Please mark your envelopes clearly with either CROSSWORD or PUZZLE.

## Crossword No 10



### ACROSS

- 3 Chip advice examination of floating water (5)
- 5 Piles a removal job (5)
- 6 Spoken chip add-on (7)
- 10 Pleasant place in yew directions to a chip (4)
- 11 A type for arrangement that is not digital (8)
- 12 Crossword rule and happens in flow (5)
- 14 Plot outside has principle algorithm (4)
- 17 Entry rate for a dealership and not the chip (5)
- 18 Return result for a single (4)
- 21 Progress and left with permission (7)
- 22 Stakes that start regulating current (5)
- 23 Top chip removed from house and returned (5)

### DOWN

- 1 Chip for Goto code (11)
- 2 Gave off and managed to become (5)
- 3 Answer that of about (5)
- 4 Not one — you happened (7)
- 5 Any well-rehearsed the investigator (7)
- 6 Open-minded, go up under a good leader (5)
- 7 Without a chip for wireless, software combination (4, 3, 4)
- 12 Seven ways to find beginning (7)
- 15 Men are changed into new identity (5)
- 16 Pairs and towers (5)
- 19 Chip in, no money (5)
- 20 Supply weapons for a member (5)

## CITIZEN PAIN

BY DAVID IRELAND and JAMES MACDONALD

HOW DID CITIZEN PAIN ESCAPE THE HORRIBLE JOB CENTRES?



HE WAS FINDING IT QUITE A PAIN.

NOT VERY MUCH.

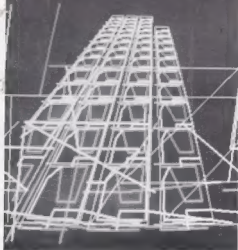


ON A GOVERNMENT TRAINING COURSE...

commodore

# COMPUTING

April/May 1986 £1.05



## An exciting new Commodore peripheral

Own or use a Pet or a Vic?

Fed up with being ignored by all the traditional monthly magazines?

Fed up with listings, which are too simple or simply do not work?

You need *Commodore Computing*, the new monthly magazine. *Commodore Computing* is published by Nick Hampshire, author of *The Pet Revealed*, *Pet Graphics*, *A Library Subroutines* and *The Vic Revealed*.

Each issue is packed with advanced

advice on how to make the most of your computer, whether you use a Pet or a Vic.

Each issue covers a host of applications – software, hardware, machine code, games, business use – whatever it is you'll find it in *Commodore Computing*.

If you want to learn more about your computer, take out a subscription to *Commodore Computing*.

That's the only way to get it, and get it straight.

Send £12.50 for 1 year's subscription (10 issues) to:

Commodore Computing,

Magsub, Oakfield House, Perrymount Road, Haywards Heath, Sussex RH16 3DH

*Bunet.*

# ANGLO AMERICAN SOFTWARE CO.

SOFTWARE SPECIALISTS

|   |  |                  |
|---|--|------------------|
| Starfleet Orion   | PET 8K<br>TRS-80 Level II 16K<br>TRS-80 32K w/disk   | £19.50           |
| Invasion Orion  | APPLE Integer BASIC 16K<br>APPLE Integer BASIC w/disk 48K<br>TRS-80 Level II 16K — ATARI 32K<br>TRS-80 32K — APPLE 48K w/disk<br>ATARI 32K w/disk                    | £19.50           |
| Temple of Apshai  | TRS-80 Level II 16K<br>TRS-80 32K — APPLE 48K w/disk<br>ATARI 32K<br>ATARI 32K w/disk<br>IBM 64K w/disk  | £23.50           |
| Hellfire Warrior  | TRS-80 Level II 16K<br>TRS-80 32K — APPLE 48K w/disk   | £23.50           |
| Upper Reaches of Apshai   | TRS-80 Level II 16K<br>TRS-80 32K — APPLE 48K w/disk   | £15.50           |
| The Keys of Acheron   | TRS-80 Level II 16K<br>TRS-80 32K — APPLE 48K w/disk   | £15.50           |
| Curse of Ra   | TRS-80 32K — APPLE 48K w/disk<br>TRS-80 Level II 16K<br>24K PET w/disk<br>TRS-80 32K<br>APPLE 48K w/disk   | £15.50<br>£32.00 |
| Introductory 3-Pack<br>3-Pack: Morloc's Tower, Rescue at Rigel and Datesones of Ryn | TRS-80 Level II 16K — ATARI 32K<br>TRS-80 32K — APPLE 48K w/disk<br>ATARI 32K 2 disk<br>PET 24K<br>TRS-80 Level II 16K<br>TRS-80 32K — APPLE 48K w/disk<br>APPLE 32K | £15.50           |
| Datesones of Ryn  | 32K PET<br>APPLE 48K w/disk  | £19.50           |
| Morloc's Tower  | TRS-80 Level II 16K<br>TRS-80 32K — APPLE 48K w/disk   | £21.50           |
| Dragon's Eye  | TRS-80 32K — APPLE 48K w/disk<br>ATARI 32K w/disk  | £21.50           |
| Sorcerer of Siva  | TRS-80 Level II 16K<br>TRS-80 32K — APPLE 48K w/disk<br>TRS-80 Level II 16K — ATARI 32K<br>TRS-80 32K — APPLE 48K w/disk   | £21.50           |
| Rescue at Rigel   | ATARI 32K w/disk   | £23.50           |
| Star Warrior  | TRS-80 Level II 16K — ATARI 32K<br>TRS-80 32K — APPLE 48K w/disk<br>ATARI 32K w/disk   | £21.50           |
| Crush, Crumble and Chomp!   | TRS-80 Level II 16K — ATARI 32K<br>TRS-80 32K — APPLE 48K w/disk<br>ATARI 32K w/disk   | £21.50           |
| Tuesday Morning Quarterback   | TRS-80 48K — APPLE 48K w/disk<br>ATARI 16K — TRS-80 Level II 16K<br>TRS-80 32K — APPLE 48K w/disk  | £19.95           |
| Ricochet  | ATARI 32K w/disk   | £21.50           |
| Jabbertalky   | TRS-80 32K — APPLE 48K w/disk<br>IBM 64K w/disk  |                  |

SEND 75p FOR FULL CATALOGUE  
(Refundable against purchase)  
DEALER ENQUIRIES WELCOME

**ANGLO AMERICAN SOFTWARE**

138a Stratford Road, Sparkhill  
Birmingham B11 1AG 021-771 2995/2736

ALL PRICES INCLUDE VAT & POSTAGE  
24 Hour answering service  
on 021-771 2995 for Access orders.



PLEASE SUPPLY

I enclose a cheque/PO for £..... made payable to  
ANGLO AMERICAN or debit my

Access and number

Signature

NAME

ADDRESS

